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ELECTRIC RAILWAYS AND THE BAGGAGE MEN.

That the electric railways in cities affect the business of the cab men is undoubtedly true, and it is also true that in some sections, at least the country roads, notably the interurban electric lines, have cut into the receipts of the steam railroads. But it seems that the effect has been felt more widely, for the Springfield (Ill.) *News* says that it has greatly reduced the income of the baggage transfer men.

The electric lines, it is said, enable one traveling man to cover twice as much territory as he could when he was forced to depend upon the comparatively few steam railroads. This would cut down the baggage carried by one-half, but the reduction has gone even further, for the traveling man now finds that he can easily cover a country district by means of the electric lines which radiate from a large town. He therefore makes the town his headquarters, starting from and returning there each day. On his trips he takes only such baggage as can be conveniently carried in his hand. Formerly, he found it necessary to go from town to town with all his samples, and in each place found the services of a transfer man necessary. Frequently, to-day, he does not find it necessary even to have his trunks hauled to his hotel headquarters. He leaves them at the baggage room, taking with him only such samples as he needs for the day's work, for by means of the excellent service afforded by the local electric lines, he covers the district in the day and by nightfall starts for the next point.

Every increase in the efficiency of our methods of doing things necessarily cuts off certain losses and seems at first to be a hardship to those who lived on these losses. In this case it is the baggage men who suffer, and there seems no help for it but that they should turn their energies in other directions and utilize their equipments in other ways. Their loss is the gain of the community as a whole, and the sooner they adapt themselves to the new conditions, the better it will be for them and us.

THE POSSIBILITIES OF THE HIGH-SPEED RAILROAD.

The application of the electric motor to meet the immediate needs of railway terminals at large cities has drawn attention for a while from the so-called high-speed railroad, the expression meaning here a road on which a speed of 100 miles an hour or more may be made on regular schedule. It has been shown pretty conclusively that there is now no physical reason why such speeds may not be attained and held, so that the problem has resolved itself into one of securing sufficient safety; that is to say, of building a suitable roadbed and of devising a suitable system of controlling the trains. The electric motor furnishes the means by which any speed which the roadbed or the car itself will stand can be maintained indefinitely.

Aside from the design of the roadbed, the method of controlling the trains therefore becomes the next in importance. As has been said, it is obvious that some extension of the block system must be employed in which the blocks are longer and the safety devices much more complete than anything in use to-day. One plan would be to divide the road into long blocks, each block ending at a stopping point, and to allow no train to start from one station until the preceding train had left the one ahead. Another plan recently proposed contemplates dividing

the road into shorter blocks with intermediate blocks each long enough to enable a train to be brought to a stop on it. The power supplied to these blocks is to be controlled by the train on the next block ahead, and is to be cut off automatically from these intermediate blocks until there is no train in the block ahead.

The interesting feature about these plans is the fact that the very means which makes it possible for us to attain such high speeds is the means which will enable us to make use of them. The electric motor is the only driving mechanism considered for such high speeds, and the electric railway system is one which readily adopts itself to automatic control. On such a road, not only would the signals be operated more or less automatically by the trains themselves, but the safety devices which would be necessary for the road would also be controlled electrically. There would be no difficulty in having the power supplied to one whole block cut off automatically by the presence of a train on another part of the road, a feature difficult to obtain if any other motive power be used.

The high-speed road is more than a probable development in railroading, and that it will be purely electrical there seems at present to be no doubt. It is because the power is supplied to the moving train from a stationary power-house that such speeds may be maintained, and the movement of the trains may be controlled automatically.

EFFECT OF RECENT SCIENTIFIC PROGRESS.

Popular writers on scientific subjects are happy if they can describe some new discovery as revolutionary, as upsetting all our old ideas and forcing us to start from a new foundation, as it were, and entirely reconstruct our theories. All of our old theories are pictured as wrong, and, therefore, are to be wiped out and an entirely new conception formed upon a new foundation with new ideas. This is, of course, erroneous, for in the first place scientific theories are stated with a reservation. They, as every one should know, apply only to known facts, and they serve merely to classify these and to suggest new lines for investigation. In the second place, scientific advance is constructive rather than destructive. It enlarges our structure rather than tearing it down. This idea was expressed by Dr. E. R. Lankester in his presidential address before the British Association for the Advancement of Science, when he said:

"The kind of conception to which these [radioactive] and like discoveries have led the modern physicist in regard to the character of that supposed unbreakable body—the chemical atom—the simple and unaffected friend of our youth—are truly astounding. But I would have you notice that they are not destructive of our previous conceptions, but rather elaborations and developments of the simpler views, introducing the notion of structure and mechanism, agitated and whirling with tremendous force, into what we formerly conceived of as homogeneous or simply built-up particles, the earlier conception being not so much a positive assertion of simplicity as a non-committal expectant formula awaiting the progress of knowledge and the revelations which are now in our hands."

The idea of the atom has been the greatest value to chemistry. Physicists can get along without it, as has been shown by Gibbs. But none of the new ideas of matter affect the atom so far as the chemist is concerned. To him, matter is still atomic; that is to say, definite portions of matter act as units and possess certain distinctive properties. No chemical reactions known are able to change the atom, and hence up to the present time, at least, it is chemically indestructible. And even should it be shown possible to transform matter of one kind into another, none of our knowledge of chemistry will become false, for no one doubts that a newly formed atom of a known element would possess all the peculiarities which distinguish that element. The chemistry of the present day at least is concerned only with atoms and atomic groups or molecules, and should it eventually be proved that the atom is transmutable, it would simply mean that a vast and unexplored field has been opened to chemistry and not that the chemistry of to-day is founded on false ideas.

Science may be compared with a large building from which we view nature as she surrounds us. Each new experiment or advance adds a little to the structure at this point, or raises that tower a little higher, or opens a window in another place, thus, in one way or the other, giving us a new view, or enabling us to see another side of some particular phenomenon. Sometimes the new addition seems to be detached from other parts of the structure, but before long, galleries are built connecting them. Sometimes it does not seem to harmonize with the whole structure, because, perhaps, the builder did not put it together just as he should, but later some one else will correct the incongruities and bring the new into proper proportion. Perhaps a new window is not opened in just the right place and it, therefore, gives a perverted view, but this is before long corrected. Perhaps the work of laying the foundations for a new addition seems to jeopardize an adjoining part of the structure, yet if the foundations of the latter are properly laid on the bedrock of facts there is no danger. And if they be not so laid the new work may make the opportunity for shoring up the endangered part until secure foundation can be laid for it. Seldom is it necessary to destroy utterly any part of the building.

Too frequently, workers in this building confine themselves more closely to their own little part than they should so that they get a perverted idea of the importance of the little view seen from their window, and even do not see this in the proper perspective. If they would only take a little excursion into another part of the building under the guidance of a friend familiar with it, they would not only get a better idea of the relation of their little bit of scenery to the rest, but they would behold it in proper proportion and would, perhaps, see something new in it not discernible from their own window.

The new discoveries of science have been truly wonderful, and no one can say where they will lead; but we have not lost anything, and all the new knowledge is pure gain.

SCIENTIFIC UNBELIEVERS.

No scientific discovery in recent times has aroused so much interest and will apparently exert so powerful an influence as that of radioactivity. The remarkable phenomena exhibited by substances possessing this property and the brilliant way in which the problems have been attacked and apparently solved, aroused universal enthusiasm. There has been a rush of workers into the new field, and a display of activity and of earnestness as has never before been witnessed. Indeed, it is possible that the very enthusiasm with which these men have gone to work has carried them further than they anticipated. Some, indeed, seem to have lost their balance, and have given expression to ideas which the conditions hardly warrant.

There is no lack, however, in the scientific world of conservative men who are wont to exert at such times their influence in preventing the acceptance of hastily proposed theories. Certain of these are now raising their voices against the latest theories of radium. At the recent meeting of the British Association for the Advancement of Science, Lord Kelvin objected to the idea that the production of helium from radium establishes the fact of a gradual evolution of one element into others, and Professor H. E. Armstrong, in a letter to the London *Times*, vigorously supports this stand. He says:

"The thanks of the public are due to Lord Kelvin for his protest against the conclusion being drawn from the evidence at present before us that it is proved that there is a gradual evolution of one element into others. No one has yet handled radium in such quantity or such manner that we can say what it is precisely. That helium can be obtained from radium appears proved, but no proof has yet been given that it is not merely contained in it.

"There was a time when the expression 'scientific caution' meant the highest degree of caution, and it was supposed to be an attribute of workers in science. Workers in the radium school appear to have cast caution to the winds and to have substituted pure imagination for it. Among ourselves we should always be at liberty to postulate the most crack-brained hypothesis, to dream the wildest dreams, as a means of guiding enquiry, but we should not court popularity on such a basis. By so doing we lose all claim to guide public opinion."

These are timely words, and the scientific world is under obligation to those who are courageous enough to take a stand against any new theory. Only in this way can the weak points of a theory be weeded out and it, itself, be gradually strengthened. But the blame for the present situation can not be laid to those who have done the most to increase our knowledge regarding the wonderful phenomena connected with radioactivity. As Professor Armstrong points out, scientists are at liberty to postulate most absurd ideas, but this is always done with a mental reservation, and proper weight is always given to such. It is the semi-scientific who seek a popular audience that turn a scientific suggestion into a statement of facts. There seems to be no way of controlling this matter and of providing the world at large with nothing but strictly scientific writings, but it is probable that if popular articles were always written with the caution employed in a scientific treatise they would lose much of their interest for the non-scientific reader, and it is a benefit to the world at large to have every one more or less interested in science. This offsets in some degree the bad effects of the poor science.

The rather small number of men who have really done the great work on radium should be given credit for their labor and the skill with which they have met and overcome difficulties. The scientific world is under a lasting debt to them, but science is never content blindly to follow one set of workers. She always insists that some one look at the matter from another standpoint and that some act as balance-wheels, so that by retarding a too hurried advance due to our first enthusiasm, we store up momentum to carry us over difficult points met further along.

ELECTRIC TRACTION IN GREATER NEW YORK.

The few statistics published in the ELECTRICAL REVIEW last week dealing with the electric railway traffic in Greater New York, throw some light on the present situation. The magnitude of the traffic in this city is shown by the figures giving the totals. During the quarter ending with June of this year, over 332,000,000 cash fares were collected in the entire city, an increase of nearly 30,000,000—a little more than nine per cent over the corresponding period of the previous year. Of this increase, the greatest part numerically took place in the borough of Manhattan, the increase there being 17,700,000. The increase in the borough of Brooklyn was something over 8,000,000. When, however, the percentage of increase in each case is determined, it is found that that of Manhattan is one of the smallest, it being nine per cent; that of the borough of Brooklyn is eight and a half per cent, while the increase in the borough of The Bronx was forty-eight per cent. These figures correspond somewhat to the increase in population of each borough, but the relation is not very clear.

The report shows that the great increase in traffic in The Bronx was due mainly to increased facilities, for the car mileage during the three months considered was about twenty-two per cent greater that it was during the previous year. The increase in car mileage in the borough of Brooklyn was about five and a half per cent, but in Manhattan there was a decrease, probably due to a better arrangement of the schedule and trains, for the service is as good.

Some idea of the tremendous traffic existing in this city is given by the figures showing the heaviest traffic on any day. The elevated division of the Interborough Rapid Transit Company carried on one day during last April 938,959 passengers. The surface lines of the New York City Railway Company carried on one day in May 1,846,538 passengers. Figures showing the greatest amount of travel on the subway are not given. The figures for Brooklyn are also significant, for the Brooklyn Heights Railway Company carried on one day during last June 2,129,264 passengers. The figures for the heaviest duty in the other boroughs are comparatively small, but it is in these boroughs where the greatest increase of traffic is taking place, due both to increased facilities and to increase in population. The figures from all the boroughs taken together show a rate of increase in traffic about three times as great as the growth of the population.

The York (England) Meeting of the British Association.

August 1 to 8, 1906. Papers of Electrical Interest.

By John B. C. Kershaw.

THE seventy-sixth annual meeting of the British Association for the Advancement of Science was held at York from August 1 to 8, under the presidency of Professor Ray Lankester, of the Natural History Department of the British Museum.

The meeting derived special interest from the fact that the association held its first meeting at York seventy-five years ago, and that many distinguished scientists were attending the 1906 meeting who were present at the Jubilee gathering at York in 1881. On that occasion the exhibition hall, in which the presidential address was delivered, was lighted by electric arc lamps, this being one of the earliest demonstrations in England of the new form of illumination, Robert Hammond, a consulting electrical engineer of London, being responsible for this innovation. The 1906 gathering of the British Association thus marks the completion of a twenty-five-years' period in the development of electric lighting in England, and an unusually large number of electrical engineers attended, in consequence, the York meeting.

The weather was favorable for the success of the numerous outdoor functions and excursions, and although the attendance, which reached nearly 2,000, was not so large as at the previous York meeting in 1881, the gathering is considered to have been above the average, as regards the value and importance of the papers and discussions. It is obviously impossible in the small space allotted to this report to give any adequate account of the whole work of the association, which is now divided into eleven sections, and covers every branch and department of natural and social science. In what follows, therefore, attention will alone be directed to the papers and discussions likely to be of special interest to readers of the ELECTRICAL REVIEW. The most important of these papers was that contributed by Sir William Preese upon "Glow Lamps Up to Date and the Grading of Voltages," read on Monday, August 6.

In this paper the author traced the history and development of the carbon filament lamp in the United Kingdom from its first introduction by Swan in 1881, down to the present date, and then gave a description of the Nernst lamp and of the newer metallic filament lamps—the osmium, tantalum, zircon—and other lamps of this character. In this connection he stated that by a new method of manufacture now adopted in the United States the filament of the carbon lamps had been rendered much denser in character. This improvement had reduced the consumption per candle-power to 2.5 watts while at the same time lengthening the life of the lamp. The metallic filament lamps, however, gave a much higher efficiency than these improved carbon lamps—the zircon, or Z lamp, the newest and latest of these, requiring only 1.07 watts per candle-power, as compared with 1.325 watts for the Nernst lamp, and 1.5 to 2.1 watts for the tantalum lamp. The mercury vapor lamp, with a carbon filament glower, was also described.

In the remainder of his paper the author dealt alone with the carbon filament lamp, and stated the urgent necessity that existed for more exact grading of voltages in these lamps as supplied to the British consumer. The very unsatisfactory results obtained in recent tests of British lamps in New York were referred to, and a strong plea was made for the introduction of a system of testing which should put a stop to the dumping down from abroad and sale in the United Kingdom of lamps so unsatisfactory as those revealed by these tests. Part of the difficulty in the United Kingdom was caused by the extreme variations in the voltage at which current was supplied, a table being exhibited which showed that only ninety-three central supply stations out of a total of 472 had adopted the standard pressures of 110 and 220 volts. The author recommended that lamps should be graded as follows:

110 volts	100	105	110	115	120 volts
220 volts	200	210	220	230	240 volts

and that every lamp should be marked with the voltage at which it must be used.

The National Physical Laboratory and Engineering Standards committee, in conjunction with the local supply authorities, ought to take the initiative in this matter, and if the electric lighting acts were at the same time amended to allow the local supply authorities to take charge of consumers' lamps, and replace the same when the efficiency had fallen below a fixed limit, the difficulties due to inefficient glow lamps would be largely solved.

The discussion upon this paper was opened by Professor Sylvanus P. Thompson, of London, who stated that in his opinion the carbon filament lamp was doomed to displacement by the metallic filament lamp, and that therefore it would be a foolish waste of time and energy to devise systems and organizations for prolonging its life. Professor Thompson illustrated his remarks by lantern slides based on Langley's researches, showing the scientific principles underlying the higher efficiency of the metallic filament lamps, and proved that though these bright filaments radiate less heat and light than the black carbon filaments, the light radiation is to a much larger extent within the range of natural vision.

Colonel R. E. Crompton disagreed with Professor Thompson and thought for the present, at any rate, the introduction of a system of grading and testing carbon filament lamps was urgently required.

As regarded the future he also disagreed with Professor Thompson, for in his opinion not metallic filament lamps—but incandescent vapor lamps—similar in principle to the mercury vapor lamp, would displace the carbon glow lamp. Already he had seen and tested one such lamp which yielded one candle-power for one-sixth of a watt; and more would be heard of this remarkable lamp—the invention of a Frenchman—shortly.

Mr. Hammond, Professor J. D. Henderson and M. Leon Gaster also joined in the discussion, and the last-named gentleman exhibited samples of the newer metallic filament lamps now being made in Germany—the best of these, the "Osram" lamp, requiring only one watt per candle-power.

The paper next to that of Sir William Preece in interest and importance was that by C. F. Jenkin, of Siemens Brothers, London, upon "The Advent of Single-phase Electric Traction."

The author called attention to the rapid advance of electric traction on railways, pointed out its advantages, and described briefly the system on which it should be carried out. Electric traction, in his opinion, will not be adopted simply to reduce the cost of hauling trains. The cost of electric hauling may be more or less than that of steam, according to circumstances. The real advantage of electrification is that it will make the line pay better. It will provide a faster, more fre-

quent and more comfortable service for the public, and consequently will attract a much larger traffic. It will provide means by which this increased traffic can be carried where this can not be done by steam. Further, it will enable new methods of handling the traffic to be adopted, such as extending the railway service on to the tram lines, providing an express service to every suburban station instead of stopping trains, and developing the traffic on branch lines upon an economical basis. Examples of these methods were described in the paper, the suggestions relating to the working of all trains express being most novel. The advantages of increased traveling facilities to the inhabitants of towns have been pointed out by Charles Booth, and the author pleads for a relaxation of the extravagant precautions now demanded in Great Britain for the public safety, and points out that these result in far more lives being lost in the crowded slums than are saved by the avoidance of rare accidents.

The merits of the two alternative systems — alternating-current transmission, continuous-current distribution with low-tension third rail; and alternating-current transmission with high-tension trolley wire—were discussed, and the great advantages of the latter were pointed out, together with the superiority of the single-phase over the three-phase system.

The equipment of a single-phase line was then described, the various features being touched on.

In conclusion the author urged the railway companies to proceed with trial lines in order to convince themselves of the advantages and possibilities of the single-phase system.

The most novel and important of the author's points were those relating to the possibility of running all trains at express speed with slip carriages for the intermediate stations, and to portions of the electrical equipment of the line for single-phase work.

The discussion upon this paper was unfortunately postponed until late in the morning, and as a result it was wholly inadequate to the importance of the subject; R. W. Cramp and Sir William Preece being the only participants. The former criticized Mr. Jenkin's remarks on repulsion motors, while Sir William Preece agreed with the author as to the obsolete character of the third-rail system of electric traction with direct current, so far adopted in the United Kingdom for railway work. It is important to note in this connection that contracts have been placed for the electrification of a short branch of line on the Midland Railway in Lancashire, connecting with its new Irish service. This line will be worked on the single-phase system, and when completed it will be the first example of single-phase traction work in the United Kingdom.

Another paper of exceptional interest at the moment for electrical engineers was that read on Tuesday, August 7, by Gerald Stoney, of Parsons's Newcastle works, upon "Recent Advances in Steam Turbines—Land and Marine."

Professor J. A. Ewing opened the discussion upon this paper and stated that the steam turbine had undoubtedly arrived, and that the next advance would be a gas turbine. In his opinion the reciprocating engine was doomed. Robert Hammond referred to the new County of London power-supply scheme, and intimated that 10,000-kilowatt steam turbines would be adopted as the units for this power-house, if the council obtained parliamentary powers next session.

Professor McCall and Colonel Crompton also joined in the discussion, and referred to the loss of efficiency shown by turbine plants after one or two years' running, due to the wear on the ends of the turbine blades. Mr. Stoney, in reply, explained the means now used by the Parsons company to prevent stripping and wear of the blades on continued running.

Troubles arising from the vibration caused by reciprocating engines in modern electricity-generating stations have sometimes led to expensive lawsuits, and therefore, some notes of a lecture delivered on Tuesday, August 7, by Professor W. E. Dalby, of London, upon "Experiments Illustrating the Balancing of Engines," may find a useful place in this report. After discussing the mathematical side of the problem, Professor Dalby showed by beautifully made working models of reciprocating engines hung on springs and driven by electric motors, that in every case the correct adjustment of the cranks or the addition of balancing weights of the right mass to certain parts of the machine or of the flywheel, would entirely stop the vibration which otherwise occurred on running. The larger problem is always how to arrange the actual working parts of the engine or machine so that the reaction on the frame, due to their several accelerations, forms a system of forces in equilibrium among themselves. This can in almost all cases be done by adjustment of the cranks, even without the addition of compensation or balancing weights.

Colonel Crompton gave an instance of the successful application of Professor Dalby's methods in an electricity station in London, where a vibration nuisance had been completely suppressed by careful adjustment of the moving parts of the engines, so as to obtain the equilibrium of forces referred to above.

All the above papers were read in Section G, the "engineering" section of the association.

In Section B (Chemistry) Messrs. Cramp and Leetham read a paper on Thursday, August 2, dealing with "The Electrical Discharge in Air and Its Commercial Application."

Since 1904 the authors have been engaged in developing an apparatus for the production of a peculiarly active gas for bleaching and sterilizing purposes, discovered by Sidney Leetham in 1903, and now much used for flour-bleaching purposes. This work has led to a number of investigations on the electrical discharge, and of its effects on air, the results of which were given in this paper.

Professor H. E. Armstrong, of London, was the chief contributor to the discussion of this paper, and stated that ozone alone when used for flour bleaching and sterilization left an intolerable odor in the flour, but that the compound gas obtained from the Leetham and Cramp apparatus gave entirely satisfactory results when used for the same purpose.

Finally a paper contributed to Section G on Friday, August 3, by S. H. Davies and F. G. Fryer, of Rowntree's chocolate and cocoa works at York, may be referred to, since the subject, "The Removal of Dust and Smoke from Chimney Gases," is one of some interest to electrical engineers.

The boiler plant at Messrs. Rowntree's works in York is somewhat small for the steam demands made upon it, and, in order to increase the capacity, induced draft has been installed with Bennis sprinkling stokers. The coal used is a dusty pea slack from the South Yorkshire coal fields, forty per cent of this fuel being fine dust and smudge. The evaporation obtained in this way is good (8.5 pounds of water per pound of coal) but an intolerable amount of dust and unburnt coal is carried up the chimney. In order to overcome the nuisance arising from this dirt and smoke discharge from the chimney top, a smoke-washing plant has been installed with entire success.

A large brick chamber, thirty-seven feet by fourteen feet six inches and seventeen feet high, has been erected between the economizers and chimney, and in this chamber, four iron baffle-plates have been fixed. Water in the form of a coarse spray is supplied by Harrison's patent spraying nozzles, and the dirt and soot carried down by the water are discharged through a water-sealed trough into an outside tank, from which they can be periodically removed. The quantity of water required to work this washing plant is about 6,400 gallons per hour, with a fuel consumption of 350 tons per week. Attempts to recover the sulphurous acid from the wash water have failed so far, and on this account a large volume of water is required in order that only a dilute-acid solution may be run to waste. The total sulphur acids in the chimney gases were reduced from 0.2 to 0.005 gramme per cubic metre, and the grit and smoke were removed completely by the use of this apparatus.

Robert Hammond, of London, was the chief contributor to the discussion on this paper. He stated that while the smoke-washing device described by the authors might prove entirely satisfactory at Messrs. Rowntree's works, it would not solve the smoke problem for electricity stations generally, since the amount of water required was almost prohibitive in all but small and exceptionally situated generating stations.

THE TWELFTH ANNUAL CONVENTION OF THE OHIO ELECTRIC LIGHT ASSOCIATION.

HOTEL VICTORY, PUT-IN-BAY ISLAND, OHIO, AUGUST 21, 22 AND 23.

On August 21, 22 and 23 the twelfth annual convention of the Ohio Electric Light Association was held at the Hotel Victory, Put-in-Bay Island, Ohio. A feature of the convention was the series of papers devoted to the commercial side of central station development. Elaborate preparations were made for the entertainment of the delegates and the ladies present, the interest being enlivened by the presentation of prizes donated by the manufacturers.

The following programme was announced:

TUESDAY, AUGUST 21.

Meeting of all committees, 1.00 P. M.

FIRST SESSION, 1.30 P. M.

Address of Acting-President W. E. Russell, Massillon, Ohio.

Papers—"High-Efficiency Lighting Units in Ohio by Central Station Men," A. N. Cope, Public Service Company, Columbus, Ohio; T. D. Buckwell and J. W. Gilmartin, Toledo Railway and Light Company, Toledo, Ohio; C. C. Collins, Columbus Railway and Light Company, Columbus, Ohio.

Papers—"New Lamps and New Opportunities," F. W. Wilcox, General Electric Company, Harrison, N. J.

General talk on Nernst lamps, Max Harris, Nernst Lamp Company, Pittsburg, Pa.

Entertainment—Automobile ride around the island and visit to the caves for the ladies; prize contests and bathing; evening band concert and reception.

WEDNESDAY, AUGUST 22—FIRST SESSION, 9.30 A. M.

"Best Methods of Increasing Business"—Papers—"As Applied to Small Cities and Towns," Samuel M. Rust, Greenville Electric Light and Power Company, Greenville, Ohio. "As Applied to Cities," W. C. Anderson, Canton Light, Heat and Power Company, Canton, Ohio. "As Applied to Large Cities," Frank M. Tait, Dayton Lighting Company, Dayton, Ohio.

"Successful Ways of Increasing Business"—Papers—J. Kermode, Cleveland Illuminating Company, Cleveland, Ohio; J. H. Maxon, Gallipolis Light and Coke Company, Gallipolis, Ohio; D. W. Low, Alliance Gas and Electric Company, Alliance, Ohio; E. H. Beil, Youngstown Consolidated Gas and Electric Company, Youngstown, Ohio; M. E. Turner, Cleveland Illuminating Company, Cleveland, Ohio.

SECOND SESSION, 2.00 P. M.

Papers—"Gas Engines in Competition with Electric Motors," Wm. Wolls, Columbus Railway and Light Company, Columbus, Ohio.

"Advertising and New-Business Getting," Chas. A. Parker, Detroit, Mich.

"Wiring of a $3,500 Residence Scientifically Lighted," J. R. Cravath, Chicago, Ill.

"Series Luminous Arc Rectifier Systems," N. R. Birge, Schenectady, N. Y.

EVENING.

Rejuvenation of Sons of Jove.

Entertainments—Card party for ladies for prizes, forenoon; bowling contest and croquet for prizes; bathing and trolley ride; grand ball, evening.

THURSDAY, AUGUST 23—FIRST SESSION, 9.30 A. M.

Papers—"Report of Committee on Cost Determination," E. J. Bechtel, Toledo Railway and Light Company, Toledo, Ohio.

"Report of Committee on Publicity," B. S. Young, Ada Water, Heat and Light Company, Ada, Ohio.

"Legislation, Its Uses and Abuses, and Report of Advisory Committee," D. L. Gaskill, Greenville Electric Light and Power Company, Greenville, Ohio.

"Report of Committee on Uniform Accounting and Records," F. E. Crawford, Library Bureau, Cleveland, Ohio.

SECOND SESSION, 2.00 P. M.

Paper—"Electric Heating Devices, their Latest Commercial Developments," H. J. Mauger, Schenectady, N. Y.

Report of secretary and treasurer.

Election of officers.

Question Box.

Executive session.

Entertainment—Finishing of contests for prizes; bathing and games.

Officers, 1905-1906—W. E. Russell, acting president, Massillon, Ohio; D. L. Gaskill, secretary-treasurer, Greenville, Ohio.

Committee for twelfth annual convention—reception committee— B. S. Young, Ada, Ohio; W. J. Hanley, Columbus, Ohio; George Dusenberre, Cleveland, Ohio; A. A. Serva, Ft. Wayne, Ind.; L. B. Hoit, Cleveland, Ohio; George Porter, Columbus, Ohio; N. C. Cotabish, Cleveland, Ohio; Elliot Reynolds, Pittsburg, Pa.

Entertainment committee—F. W. Wilcox, Harrison, N. J.; A. C. Robeson, Greenville, Ohio; Fred Bissell, Toledo, Ohio.

Committee on Arrangements—E. J. Bechtel, Toledo, Ohio; M. C. Hull, Columbus, Ohio; E. F. Gwynn, Delaware, Ohio; E. H. Beil, Youngstown, Ohio.

CONTESTS AND PRIZES FOR THE LADIES.

Contest No. 1, Euchre Party—First prize: Electric breakfast set, consisting of chafing dish, cereal cooker and coffee percolator, donated by General Electric Company; second prize: One alternating fan donated by Westinghouse Electric and Manufacturing Company; third prize: One piece cut glass donated by Libby Glass Works; fourth prize: One electric flat-iron donated by the W. J. Barr Electric Manufacturing Company; fifth prize: One curling iron donated by the W. J. Nagel Electric Company.

Contest No. 2, Guessing Contest—First prize: One French coffee urn donated by Electric Appliance Company; second prize: One oscillating fan donated by the Robbins & Myers Company; third prize: One electric water heater donated by the Fisher Electric Company; fourth prize: One electric flat-iron donated by American Electrical Heater Company.

Contest No. 3, Bowling—First prize: One electric stand lamp donated by Post-Glover Electric Company; second prize: One alternating fan donated by Westinghouse Electric and Manufacturing Company; third prize: One electric flat-iron donated by Cleveland Electrical Supply Company; fourth prize: One heating pad donated by General Electric Company.

Contest No. 4, Croquet—First prize: One stand lamp donated by Moreau Gas Fixture Manufacturing Company; second prize: One desk fan donated by the Star Electric Company; third prize: One desk fan donated by the F. Bissell Company; fourth prize: One electric flat-iron donated by the Erner Electric Company.

Contest No. 5, Tennis—First prize: One drop-head sewing-machine motor donated by Doubleday-Hill Electric Company; second prize: One revolving electric fan donated by Ft. Wayne Electric Works.

Contest No. 6, Natatorium—First prize: One Cleve glass dome donated by Cleveland Window Glass Company; second prize: One disc stove donated by General Electric Company.

An Exposition of Safety Devices.

The American Institute of Social Service will hold in New York city, in January next, an exposition of devices for safeguarding the lives and limbs of working men and women, and for preventing accidents under the ordinary conditions of life and labor to which the general public is exposed. Requests for information regarding space should be made to Dr. William H. Tolman, director, 287 Fourth avenue, New York city.

The Electric Railroad between Schleitheim and Schaffhausen, Switzerland.

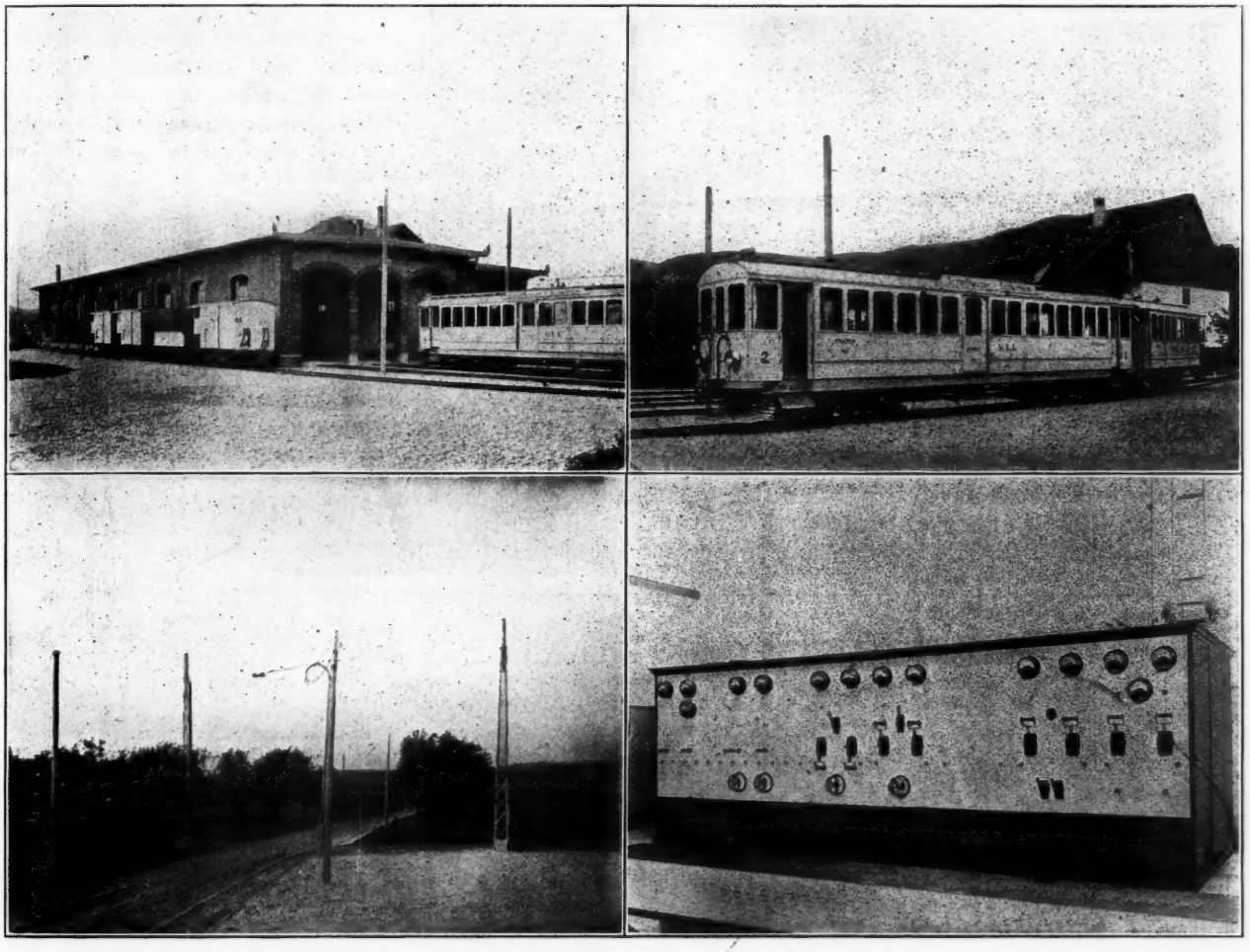
By Frank Koester.

RECENTLY a street-railway system was installed between Schleitheim and Schaffhausen, in northern Switzerland, which has many interesting features. The road is 10.3 miles in length and runs for the most part on the Canton road, the greatest grade being one of six per cent, which, however, is only for a distance of 170 feet, the smallest curve having a radius of forty feet.

In cities and at street crossings the rails are of the flanged type, while at all other places the Vignole type is used, the gauge being one meter (3.28 feet). The road-bed is 6.7 feet wide and is made of ballast twelve inches thick. The rails rest on iron ties and are forty feet long, weighing 30.8 kilograms per meter.

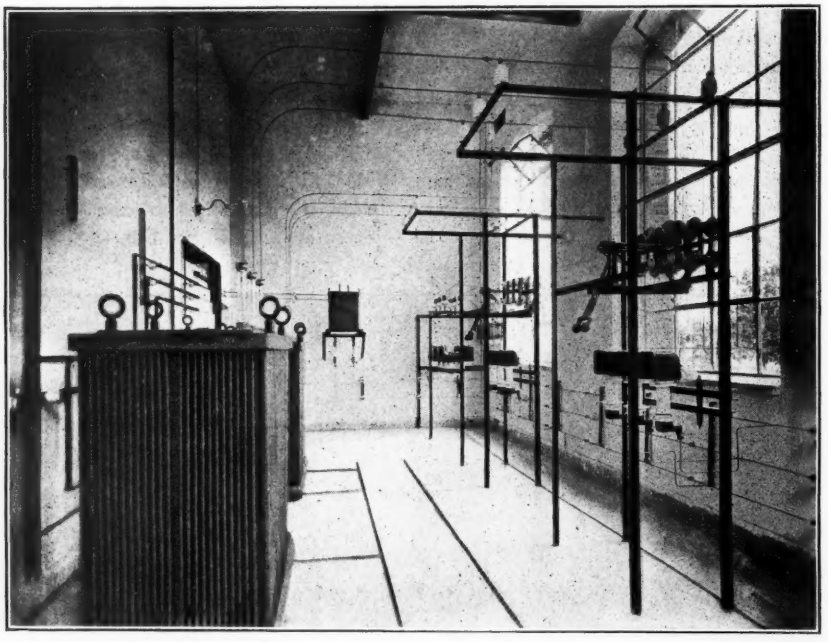
The power to supply the road is taken from the power-house at the city of Schaffhausen, where there are installed two 150-kilowatt transformers which step up the pressure to 10,000 volts, at which it is distributed to the transformer stations along the road, being again reduced to 380 volts, there being in each station two step-down transformers and two motor generators of 165 horse-power each, the alternating motor, of the Oerlikon type, consisting of a stationary primary winding and a rotary induction winding while the directly connected generator—110 kilowatts—has its exciting coils connected in shunt, taking current directly from the bus-bar system. The efficiency of the set is ninety-two per cent at full load, ninety-one per cent at three-quarter load, and ninety per cent at one-half load. The sets are mounted upon insulators on the foundation, as is frequently found in Swiss practice. For equalizing the load there is a battery comprising 390 cells with a capacity of 200 amperes. The feeders from the transformers to the bus-bar system are provided with two three-pole switches, six one-pole fuses and two ampere-meters provided with measuring transformers. Between the transformers and the motor-generators are also two three-pole switches, the fuses and an ampere-meter. There is also a starter with which the machines are brought up to speed before being thrown on the line. The generators and battery feed to a common bus-bar system and are well provided with switches, fuses, and ampere-meter, while the outgoing wires are provided with all necessary measuring instruments, switches and trusses, as well as lightning arresters.

The switchboard, containing eight panels, consists of a steel frame upon



SCHAFFHAUSEN-SCHLEITHEIM ELECTRIC RAILWAY—CAR BARN; MOTOR CAR AND TRAILER; TROLLEY SUSPENSION SYSTEM; DIRECT-CURRENT SWITCHBOARD.

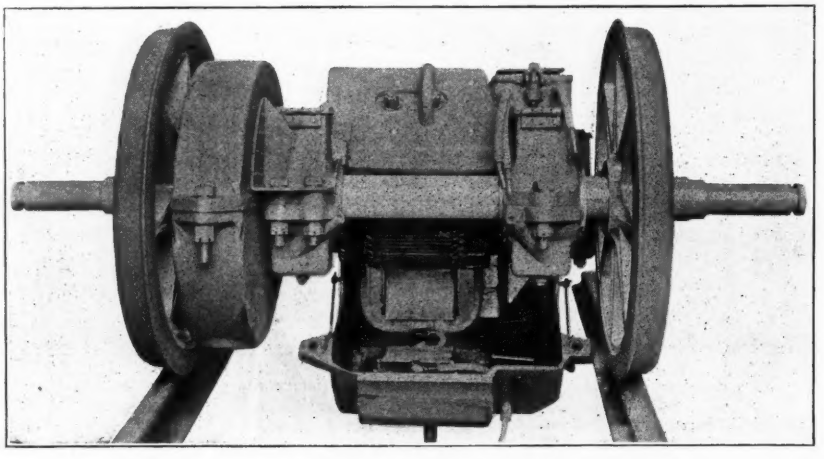
which are mounted white marble slabs bearing the necessary instruments and levers, while the lower portions as well as the sidewalls are covered with perforated sheet iron.



SCHAFFHAUSEN-SCHLEITHEIM ELECTRIC RAILWAY—INTERIOR OF TRANSFORMER STATION.

The trolley is made of a copper wire of eighty square millimetre sectional area and carried by suspension wires on wooden poles twenty feet above the ground.

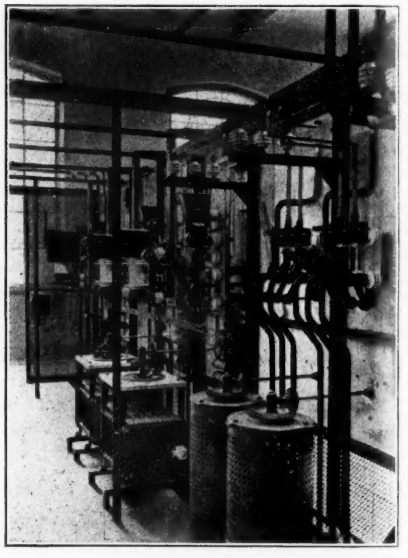
The feeder wires are carried partly on poles and partly on suspension wires, the rails being used for the return. The rail bonds consist of eight millimetre copper wire, every tenth rail joint being interconnected by copper wire in a similar way.



SCHAFFHAUSEN-SCHLEITHEIM ELECTRIC RAILWAY—CAR MOTOR.

The rolling stock, consisting of four motor-cars, three trailers, five box cars and three flat cars, were built by the Swiss Industrial Company, of Manhausen, the electrical equipment being installed by the Oerlikon Company. The motor-cars are of the two-truck type, the distance from centre to centre of which is 28.2 feet, while the entire length over all is 49.2 feet. The cars are provided on each end with sliding doors giving access to a smoking compartment, each having a seating capacity of eighteen, between which there is a small space for parcels-post but which may, should occasion demand, be used as a passenger compartment and is provided with four folding seats and has standing room for four. With the seats folded the cars accommodate twelve passengers standing. As the rear platform can accommodate four passengers standing it will be seen that the whole car can, when the occasion demands, accommodate fifty to fifty-two passengers without being overcrowded.

The braking system consists of a Boecker air-brake and a hand-brake working in combination, which can be operated from either platform, and also an electric solenoid brake. Should the brakes on either truck be out of order there is an arrangement on each platform whereby the brakes on the other truck may be operated independently. The fender and sand box are operated pneumatically in connection with the air-brakes, the sand in the sand box being heated by electricity to prevent the sand from gathering in lumps in damp weather, for which about 800 watts have been found to be necessary. Each car is provided with four forty-five-horse-power, 750-volt Oerlikon motors geared to the wheels in the ratio of one to five. The large wheel is of cast steel, and the smaller one of a harder grade steel. The compressor for the air-brakes is mounted directly against the motor



SCHAFFHAUSEN-SCHLEITHEIM ELECTRIC RAILWAY—REAR VIEW OF DIRECT-CURRENT SWITCHBOARD.

casing and operated by gearing from one of the main motors, thus eliminating the compressor motor. The controlling system is designed so as to allow the motors to be operated either in series or parallel and is provided with an arc extinguisher. The cars having two trolley poles are equipped with an automatic circuit-breaker which may also be operated by hand, and also with lightning arresters, all cars being lighted and heated by electricity.

The trailers are of the two-axle type, having a seating capacity of twenty-four and standing room for eight, and are equipped with air-brakes which may be operated from the main car or from the platform of the trailer itself.

RAILWAY-MOTOR-CAR TRAFFIC.[1]

BY T. HURRY RICHES AND SIDNEY B. HASLAM.

The best method of conveying passengers clearly is that one which yields the best results in the balance sheet, and at the same time gives satisfaction in other ways. The opinion held by most locomotive engineers, and by a large number of electrical engineers, on the broad and general question of railway electrification, is that for suburban close traffic only is it justifiable. It is suggested and maintained that the electrification of branch and main line traffic will, as a general rule, result in a loss to the railway company, as the load-factor at the power-station will be a very poor one, owing to the intermittent traffic. On the other hand, suburban traffic, especially if in thickly populated areas, calls for a more frequent service and a greater acceleration of speed than is attainable with ordinary passenger trains. It is not only desirable but is quickly becoming a necessity that, if the suburban railway system is to hold its own with municipal tramway competition, a frequent service with high acceleration must be established in suburban districts. It was to meet this competition that one or two attempts were made to produce self-contained cars on various lines in the early part of the last century. While these cars were more or less a success, the requirements were not then great enough to encourage continuation.

It may not be out of place to mention here that in 1873 or 1874 a Mr. Rowan designed and built self-contained steam cars for which he could find no sale in this country. His cars were, however, taken up to a certain extent abroad, notably in Austria and Switzerland. In 1902, however, the competition of street cars in the suburban districts, especially around London, became more acute, and caused the railway companies to give serious thought to the matter and railway motors were introduced by the London and South Western Railway Company as an experiment. This proved so far successful that the Great Western Railway Company and the Taff Vale Railway Company followed by building cars for trial upon its railways to fulfil the requirements of a more frequent service upon sections in certain districts where traffic was light. It was obviously impossible to run such a frequent service with ordinary trains as being too expensive, the running expenses and the capital outlay involved being too great in proportion to the passengers carried. It was then seen that the solution of the difficulty lay in self-contained cars, and the question of what motive power to use then arose; steam or electricity, and if electricity, which of the many methods of application would be employed. Many people doubtless think that electricity is the only panacea for everything, but the problem is, of course, purely one of commercial results. The authors hope later on to prove, by giving comparative figures, that for lines where the service is necessarily light and intermittent, and where the distances to be run are several miles, the power-house would need to be large in proportion to the average work done; and where heavy gradients have to be worked, the peak-load would be large in proportion to the average and minimum, and rapidly fluctuating therefrom. The necessarily large units which would have to be provided in the generating station to meet this maximum motor power and high peak-load, would be large, and consequently the capital outlay would be out of proportion to the work done.

The first railway to move in the direction of self-contained car traffic was the London and South Western Railway Company which placed a steam car on its line between Fratton and Southsea in 1903. This car, which was equipped with small cylinders and a vertical boiler, was fairly successful, and encouraged the idea that progress in this direction promised a solution of the problem. The next railway company to move was the Great Western Railway Company, who adopted the four-wheel coupled type, the boiler being vertical and the engine being placed under the car. This car, which had to contend with heavier gradients than the car of the London and South Western Railway Company, was necessarily more powerful.

About the same time, or immediately afterwards, the Taff Vale Railway Company, which had for some time been considering the various possible methods of treating this problem, put its first car on the rails. This car, which was different in several important features from those previously mentioned, was deemed so far satisfactory that a further six were ordered. Owing to the heavy gradients to be overcome, namely, one in forty, it was necessary that more provision should be made for dealing with these heavy gradients than had previously been made in cars. The engine and boiler of this car were made separate from the carriage-body, while the leading wheels of the four-wheeled bogie, which carried the engine and the leading end of the car, were made the driving wheels. The boiler was of a design giving a large heating surface (in comparison with the small space occupied by the boiler) and therefore fulfilling that most essential requirement of raising steam rapidly. The engine was of the outside cylinder type, carried beneath the boiler, while a novel feature of the car was the ease with which the body could be detached from the engine. The next railways to deal with the subject were the North Eastern, Great North of Scotland, Great Central and the Great Northern.

Before coming to the actual experience of the authors and the reasons which caused the adoption of steam cars on the Taff Vale Railway, the authors wish to point out that this is not done with any idea of comparison with other systems, but given merely as first-hand information. The Taff Vale Railway Company has a certain branch, which, owing to the paucity of passengers as a general rule, was not as profitable to work as was desired, and it was to this branch that attention was first drawn for any better and cheaper method of working. To be sure of getting the best results, careful comparisons were taken of the cost, both capital and running, of steam and electricity, the latter of which was subdivided as follows:

1. Self-contained cars, that is, worked with secondary batteries.
2. Third-rail system.
3. Overhead system; (1) with bonded rail return; (2) with new return rail.
4. With lead and return rails.

With a view to gaining experience in the methods obtaining abroad, one of the authors visited Belgium, France, and Germany, and also collected information from all parts of the world where electricity was being used for railway traction, and the matter was thoroughly gone into. Various makers were asked to tender for the different classes of equipments, and the cost was carefully summarized. It was at once seen that the expenses of sections 2, 3 and 4 were much too costly, the manufacturers and contractors, in fact, preferring not to quote for these, on account of this great initial expense. The cost of a car with dynamo, driven by a petrol-engine with accumulators for working in parallel with the generator when necessary to overcome stiff gradients, was also considered. The outlay for this was, however, enormous, as the equipment, besides the above, also comprised a milking booster and two seventy-five horse-power motors, and caused the scheme to be abandoned.

The idea of a car run by current from secondary batteries was, however, given

[1] Abstract of a paper read at the recent meeting of the Institution of Mechanical Engineers of Great Britain, at Cardiff.

more consideration, and one of the authors visited Belgium and Swansea, and examined the cars used there, which at that time were run by storage batteries. The gross weight, without passengers, of each car was forty-five tons and nineteen tons seven hundredweight respectively, and the seating accommodation was in Belgium fifty to sixty, and at Swansea forty-two inside and fifty-seven outside. The capacity of the batteries was 140 ampere-hours, and the normal discharge rate twenty amperes at Swansea and 250 ampere-hours with discharge rate of 125 amperes in Belgium.

The general conclusion arrived at on the subject of battery cars was not favorable, as their first cost, namely, £4,000-£5,000 ($20,000-$25,000), was high, and their maintenance was also excessive, while their weight and periods of inactivity when charging (a time equal to their period of activity) were all features which did not compare favorably with steam cars.

The results of the costs of the other sections are given in Table 1, and the running cost of an ordinary train is also given as a comparison, as well as the actual cost of the self-contained steam car.

These figures were based on the original design of the Taff Vale Railway Company's car to hold fifty-two passengers, its latest design holding seventy. The conclusion drawn from these figures was, that unless the service is very frequent, that is, a train every few minutes, and the maximum distance from the power-house short, the steam service is better and more economical than the electrical. The question of taking current from a supply company in preference to installing generating plant was also thoroughly considered, and there is no doubt that when the amount of current or load-factor fluctuates much, or where the power is originally small, the supply company can work at a considerably cheaper price per unit. Again, if the distance is great, that is, if the start and finish of that part of the line which is to be electrified are some way apart, a considerable point in favor of the power supply is raised, as the current could be supplied at two or three points along the line, thereby doing away with and saving a considerable voltage drop and the resultant losses and the increased outlay. In the question of steam and electricity the subject of control has also to be considered.

It is worthy of remark that even those railways which have gone in for the electric system have mechanical braking on their cars in preference to electrical, and it is generally held that the steam cars are, as a whole, more amenable to requirements and more easy to control. The usual system of braking on electrical railway cars is one or another of the ordinary air or vacuum brakes—the pump being driven by a small electric motor.

It was while these results were being arrived at that the London and South Western Railway Company placed its steam car on the rails. The Taff Vale Railway Company having satisfied itself that the steam car was undoubtedly the most economical for its purpose, then designed and placed one on the rails, suitable for carrying the above-mentioned fifty-two passengers at a maximum speed of twenty-five miles per hour, and having a capacity of acceleration of thirty miles per hour in thirty-two seconds. This speed of twenty-five miles per hour, however, was found to be insufficient, and the greater speed, which had to be and was attained, caused at first some considerable trouble in axle-heating. Since then the journals of the driving wheels have been increased in length to ten and one-half inches instead of seven inches, and with other small alterations the car now attains a speed of thirty-five miles per hour with ease.

This railway company has also an electrical car running between Scarborough and Filey, which is operated in a somewhat novel way. A storage battery of thirty-eight cells is suspended between the frames and supplies current to the generator, which is used as a motor to start up the petrol engine. After the engine has been started the current is switched off and the motor takes its proper place as a generator. A small exciter is used both to excite the main generator which drives it and to supply the lighting current for thirty seventy-two-volt sixteen-candle-power lamps. The voltage of this machine can be increased to ninety-five volts for charging the battery when not required for lighting.

Missouri Pacific Railway Car—This company is now building a car which is being manufactured by the St. Louis Car Company, the special feature of which is the engine, which is being manufactured under the Wagenhal's patents. The engine is the double-cylinder actuated by the Stephenson link-motion. The frame of the engine will be secured to the rear of the frame of the truck, and the forward end of the engine frame will be secured in journal-bearings on the axle. The crank-disc will be located on a jack-shaft carrying a gear which will mesh into a gear on the axle of one pair of wheels. Steam is generated with oil fuel, of which the car will carry 1,000 gallons, and the engine will develop 275 horse-power.

Port Talbot Railway Car—The car being built to the order of the Port Talbot Docks and Railway Company is well worthy of mention, and presents many novel features. The motor bogie is a six-wheel coupled type, with three-foot wheels, the valves being operated by an adaptation of the Walschaert's gear. The car is lit by electricity generated by a steam turbine-driven dynamo. The gradient this car has to work is extremely stiff three miles of one in forty.

The details and remarks, given in table 2, on some of the best-known electric railway systems, may be of some interest.

It is a fact worthy of remark that, while the Metropolitan, North Eastern, and Liverpool & Southport, are the only English electric railways to make use of high-tension transmission, all the foreign ones do so with the exception of the

TABLE 1.

COMPARATIVE COSTS.

Details.	Cost of Original System. Small Engine and Train.	Secondary Battery. Own Power Supply.	Secondary Battery. From Supply Co. at 2c. per Unit.	Third-rail System from Supply Co.	Steam Cars.
I—Single car:					
Capital cost.....	1/3 engine, per day..$3,665 Carriages.. 8,875 $12,540	Car complete.... $20,000 Generating station... 5,750 $25,750	Car..... $20,000 Transformers..... 500 $20,500	Car..... $6,750 Preparing six miles of rails.. 35,680 $42,430	Car..... $10,500
Interest at 4%.....	$500	$1,030	$820	$1,695	$420
Maintenance, wages, etc.....	4,875	3,580	2,710	3,400	1,255
Total.....	$5,375	$4,610	$3,530	$5,095	$1,675
Giving, at 11,000 miles per annum, a cost per mile of.	46.9 cents	40.04 cents	30.8 cents	44.22 cents	15.48 cents
II—Two cars: Cost per mile.....	.....	39.2 cents	30.6 cents	38.6 cents	.....
III—Three cars: Cost per mile.....	.....	38.8 cents	30.4 cents	28.2 cents	.....

Boston Elevated and Grenoble-Chapriellan. The Isle of Man electric tramways, while perhaps not coming under the description of an electric railway, may be mentioned here, owing to the fact that it transmits the power at 6,000 volts.

Again, the foreign railways are the only ones up to the present, with the exception of the Metropolitan, who have made use of the turbine to provide the motive power to the dynamo. In the case of the Grenoble-Chapriellan, this motor power is supplied by a waterfall 1,476 feet high, and is distributed to the turbines from a collector placed outside the station.

The Valtellina Electric Railway also derives its motive power from water. In this case the water is taken from the river Adda, and has a flow of 550,000 cubic feet with a maximum head of ninety feet, and is sufficient to develop 7,500 horse-power.

The advantages of the rail-motor system of carrying passengers may be placed as follows: owing to the small unit a much more frequent service is given with a better percentage of freight to dead weight hauled, while the mileage cost of working is only about one-third the cost of an ordinary passenger train-mile. The facility of picking up and setting down passengers at line crossings, small villages, etc., makes the service more popular, and enables many passengers to travel who would not otherwise be able to. The rapid rate of acceleration makes the through-speed higher. The experience of those railways who have given both an extensive trial is that the system is equally advantageous for heavy and sparse traffic. In the first case the motors sandwiched in between the regular trains find a traffic without taking it away from the trains, while in the second the traffic has been developed by the more frequent service. The number of steam cars at present running, and the ever-increasing number both at home and abroad proves their utility, and it seems certain that in them railways have the best, and in fact only, effective answer to street-car competition.

TABLE 2.

DETAILS OF ELECTRIC TRACTION ON THE VARIOUS RAILWAYS SHOWN BELOW.

Name of Railway.	Gross Power in Kilowatts.	Pressure Generated in Volts.	Pressure Used in Motors, in Volts.	Gross Power Capacity of Each Train.	Number of Passenger Seats per Train.	Ruling Gradient.	Remarks.
Liverpool & Southport	6,750	1,500 (3 phase)	600 (direct current)	H. P. 1,200	270	1 in 85 for a short distance	
Great Northern & City	3,200	500 (direct current)	500 (direct current)	500	50	1 in 30	
Mersey	4,650	650 (direct current)	650 (direct current)	400 (single) 800 (double)	Average per train = 60	1 in 30; maximum 1 in 27	Secondary batteries are utilized in the generating station for taking peak loads.
Liverpool Overhead	5,400	500 (direct current)	500 (direct current)	400	160	1 in 200	"
Metropolitan	14,000	11,000 (3 phase)	550 (direct current)	1,200	322	1 in 44 for about 14½ chains	
North Eastern	11,200	6,000 (3 phase)	600 (direct current)	600	186	1 in 27 (goods line) 1 in 50 (passenger line)	
Liverpool & Manchester	6,000	10,000 (3 phase)	550 (direct current)	560	35	.....	Proposed monorail.
Central London	.....	500	500	....	336	.....	
Metropolitan District	4,000	550	550	1,600	312	1 in 43	
City & Waterloo	1,200	525 (direct current)	500 (direct current)	160 (single) 320 (double)	50 204	1 in 30 for a distance of 900 feet	
Boston Elevated	36,844	550	550	1,200	192	1 in 20	
Paris Metropolitan	6,000	5,000 (3 phase)	600 (direct current)	200 300	60 per car	1 in 3.6	
Paris-Orleans	2,060	5,500 (3 phase)	550 (direct current)	668	525	1 in 100	
Grenoble-Chapriellan	750	600 (direct current)	600 (direct current)	70	36 per car	.....	Water turbines.
Lecco-Sondrio (Ganz)	4,476	20,000 (3 phase)	3,000 (direct current)	600	56 per car	.....	Steam turbines.
Valtellina Electric	6,000	20,000 (3 phase)	3,000 (direct current)	600	170	1 in 50	Water turbines.
Burgdorf-Thun.	3,720	4,000 (3 phase)	750 (direct current)	240	136	1 in 40	Steam turbines.

Divided Poles and Field-Winding Litigation.

TO THE EDITOR OF THE ELECTRICAL REVIEW:

In the legal paragraph in your paper issued the 21st inst., 1906, on page 117, there appears an article under the subject of divided pole and field winding, pertaining to the Emerson Electric Company *versus* Century Electric Company litigation. This article is somewhat misleading if read by our customers, as these are the facts: Just before the Emerson Electric Company brought to our attention the fact that they considered we were infringing their patent, we had developed a new style of field winding and immediately commenced to use it. The Emerson Company sued us and we made answer to the suit, but refused to go to the expense of taking any testimony as we were not interested in breaking down this patent, and therefore the decision was rendered as stated in your paper. You might therefore state that this decision was rendered on account of our not contesting the suit, not having any interest in the same on account of our having developed a field winding that suited our conditions much better and that enabled us to accomplish the same results with considerable saving in material; and therefore the court has not passed on the validity of this patent.

We trust you will make such mention of this as is necessary to place this matter in the right light before our customers.

CENTURY ELECTRIC COMPANY.

St. Louis, Mo., August 7.

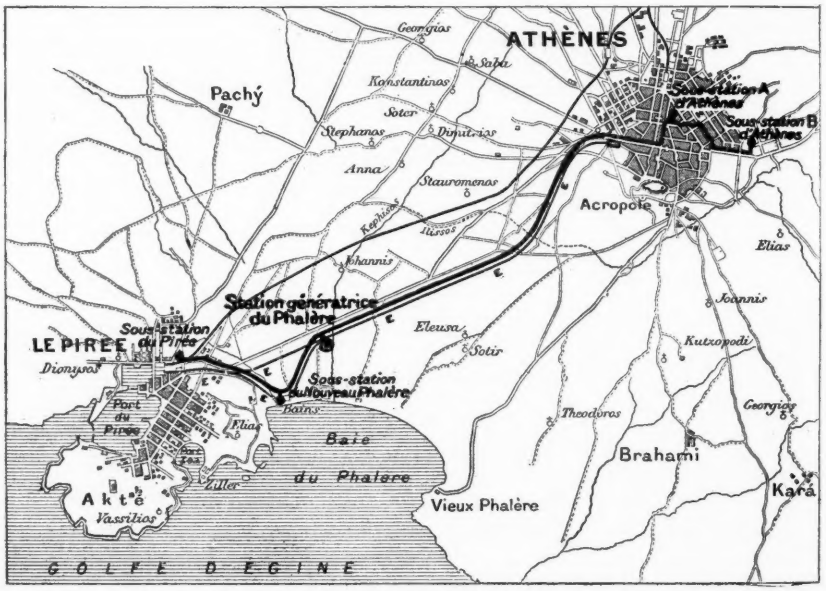
Nernst Lamps for the New York Terminal of the New York, Pennsylvania & Long Island Railroad Company.

It is announced that after an exhaustive study of all commercial systems of illumination, the engineers have decided to use the Nernst lamp for a large proportion of the illumination of the New York terminal of the New York, Pennsylvania & Long Island Railroad Company. The main waiting room is approximately 100 feet wide, 300 feet long and 167 feet high. The building itself is approximately 450 feet wide, 800 feet long and 100 feet high, divided into waiting rooms, dining rooms, arcades, offices for railroad officials, baggage rooms, drawing rooms, concourse and train platforms. On account of the great variation in the architectural features of each room, no uniform arrangement of lamps was permissible, each room being a problem in itself. It is estimated that about 20,000 glower units will be used.

New Electrical Installations and Apparatus on the Continent.

By C. L. Durand.

AMONG the most important of the electrical enterprises which have been undertaken within recent years in the Mediterranean region is the large electric plant erected in order to supply the city of Athens and the surrounding district, besides the three lines of electric railroad which now connect that city with the coast. Before the present plant was erected, the city of Athens had a comparatively small station which furnished the lighting current, but as the demands for current were constantly increasing it was found necessary to enlarge the plant considerably. Lack of water supply within the city made it practically impossible to do this, and therefore it was decided to erect a large plant at a point near the coast and to generate alternating current, this to be carried over a transmission line to Athens and to be converted in a number of substations. Accordingly the main plant was erected at Phalere, and at the same time it was proposed to extend the field of operations so as to furnish current for the surrounding district, including the port of Piræus, the locality of Phalere, which is a favorite bathing resort, and the town of Kiphissia, another summer resort. A large amount of current was also to be supplied to the lines of electric railroad which were then about to be put in operation. Thus it will be seen that a large station was needed from the outset, and this has since been increased in capacity. The equipment of the plant and the electric roads was carried out by the Hellenic Electric Company, and the material furnished by the Thomson-Houston Company. The station at Phalere is situated some 3,000 feet from the sea, where a good supply of water at a depth of eighteen feet was secured. When complete, the station is to contain six main groups of 750 kilowatts each. Three of these groups will supply alternating current for the district, and two groups will furnish direct current for the Athens-Piræus electric road which passes near this point. A sixth group, composed of a 1,000-horse-power engine coupled to an alternator and a generator of like power, will act as a reserve for either kind of current. At present two of the alternator sets have been installed for the lighting circuits. Each of these consists of a triple-expansion engine having four cylinders placed two in tandem on either side. The engine will develop 1,000 horse-power and is run at ninety-four revolutions per minute. Upon the flywheel is mounted the revolving field of the alternator. The alternators are of the 750-kilowatt, Thomson-Houston pattern, and, like all the rest of the material, were built at Paris. At ninety-four revolutions per minute these machines will deliver 5,500 volts. For the electric road, two other groups have been installed. One of these is a direct-current generator working at 600 volts, while the second group has been designed to furnish both kinds of current, and the engine drives two machines at the same time, one of these being an alternator of the same type as above and the second a 750-kilowatt generator. All the engines are of the Escher-Wyss pattern, and the alternators and generators are all designed to give 750 kilowatts, using the same type of machine for each class.

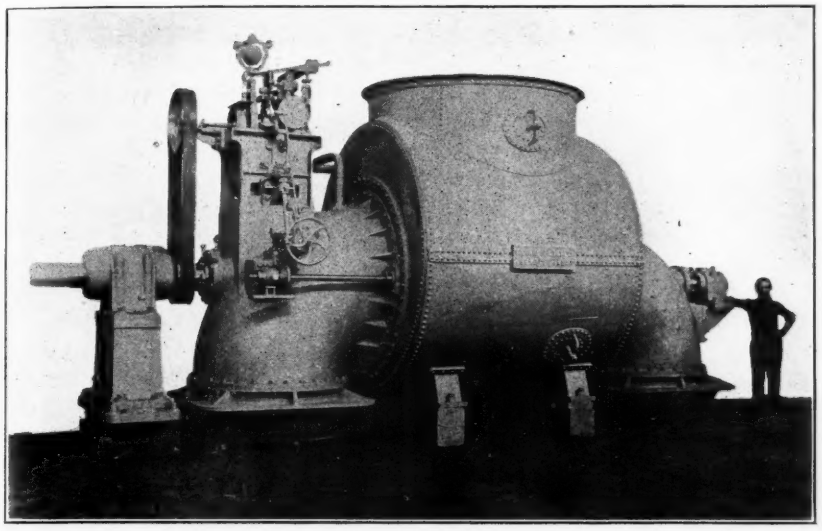


MAP SHOWING ATHENS TRAMWAY SYSTEMS AND LOCATION OF SUBSTATIONS. EE SHOWS ELECTRIFIED STEAM LINE.

A large boiler plant has been installed in the station, consisting of eight tubular boilers having 280 square yards heating surface each, and provided with superheaters of seventy square yards surface. The superheaters raise the steam to 300 degrees centigrade. Each of the boilers can produce 7,000 pounds of steam per hour, at thirteen atmospheres pressure. A set of four feed-water heaters is used in the boiler plant. The boiler-feed is assured by two duplex compound steam pumps. Sea water is employed to good advantage for cooling the condensers, and motor-driven pumps are used for the water supply. At either end of the dynamo hall is a large switchboard for handling the circuits of the alternators and the generators. Two overhead lines run from the station to the city of Athens. In general they are worked in parallel, but one of them can be worked alone, if need be. The distance from the plant to the city is about four miles and the line, which operates at 5,500 volts, is formed of six wires of fifty millimetre section. Wood poles are used to support the wires. The line follows along the tracks of the Athens-Piræus railroad. At the station of Theseus, lying on the edge of the city, the line runs in underground cable to the terminal point within the city, for a distance of one mile or less. Here are used two cables of three conductors each. From the generating station proceed two other overhead lines, one of which runs to the substation of Piræus over a length of 1.6 miles, while the second passes to the Phalere substation located some 3,000 feet off.

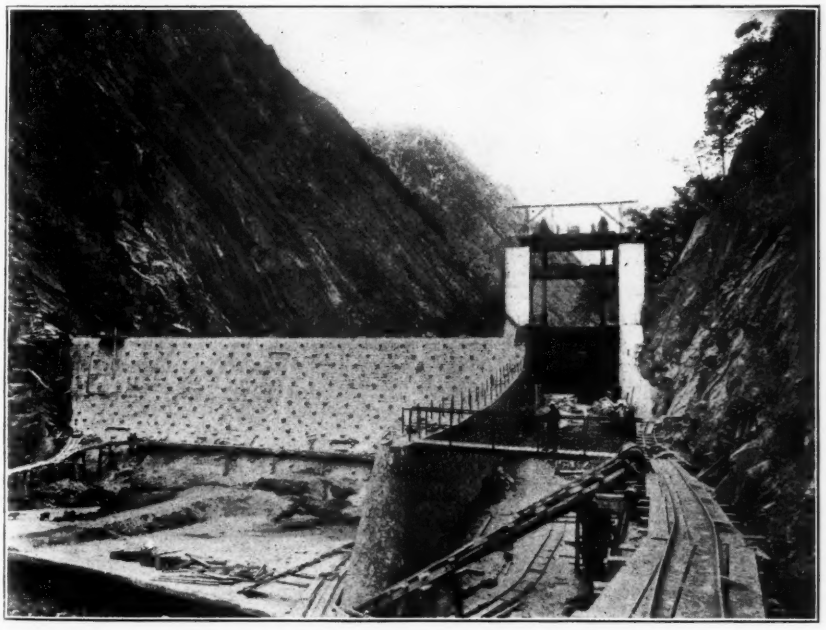
Athens is connected with the coast at the Piræus by three lines of railroad. The first of these lines belongs to the trunk line which runs to the south, and passes by Athens where the station is located in the suburbs. The second line which has been laid within a recent period, runs from the Piræus to Larissa, and is eventually to be connected with the Continental lines. At Athens the station is also placed in the suburbs. The third line of railroad, which has recently been

electrified, belongs to the Athens-Piræus Railroad Company. From the Piræus the road bends to the south to take in the Phalere beach station and then proceeds to Athens, where it passes by the Theseus



One of the 1,750-Horse-Power Turbines for the Avignonet Plant.

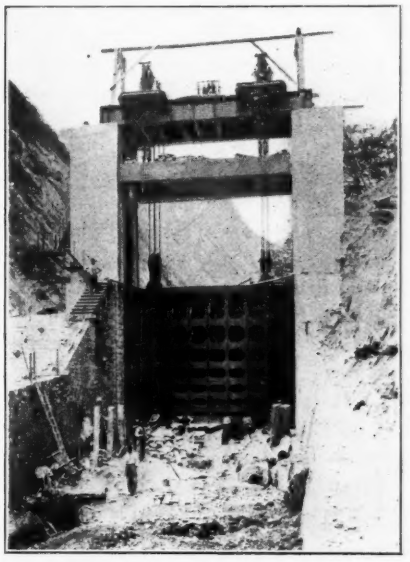
station on the outskirts of the city and then runs in tunnel to the two stations lying within the city. As the use of steam trains upon this line proved unsatisfactory for many reasons it was decided to electrify the road, and to take the necessary



Dam and Overflow Gate, Avignonet Plant.

current from the new Phalere station. To this end two feeding points are used for the line. One of these is located at the Phalere plant, while the second is placed at the substation "A" at Athens. The group lying within the main station which is used for the railroad line has accordingly a direct-current-generator. The third-rail system is used on the electric line. During the summer season the traffic is very high during certain periods. To carry on the traffic under these conditions the Mediterranean Thomson-Houston Company, which is a branch of the main Paris company, furnished forty cars of a type resembling the motor-car used on the Paris Metropolitan Subway, along with trailers of about the same appearance. These cars are of a square build with two sliding doors at the side and a central passage. Another type of car has two compartments for first and second class, and three doors. These cars are mounted upon bogies containing Thomson-Houston motors. In general they have seating capacity for forty to forty-eight persons. Each motor-car is equipped with two motors which are similar to those which have been illustrated in a recent number as operated on the Paris subway, and the system of multiple-unit control for the circuits has also been adopted in this case. Some of the cars are a combined freight and passenger pattern, but as the freight traffic is increasing, it has been decided to build a type of freight car which resembles the others in appearance.

Within the city of Athens have been installed two substations. The larger one, known as station "A," contains stepdown transformers which lower the line voltage of 5,500 volts to 170 volts, and a set of rotary converters takes this current and supplies 250 volts direct-current. Substation "B" lying in the suburbs, is used to raise the voltage on the part of the line lying farthest from station "A." Here are two groups each formed of a ninety horse-power synchronous motor running on the three-phase line current at 5,500 volts, and a sixty-kilowatt generator furnishing 250 volts. At the Piræus is a substation for supplying the lighting current for the town and the port, and at Phalere, on the coast is a similar station. Later on, a line has been run from the central station to the summer resort of Kiphissia, where is placed another substation. To supply part of the current for the electric railroad, two special rotary



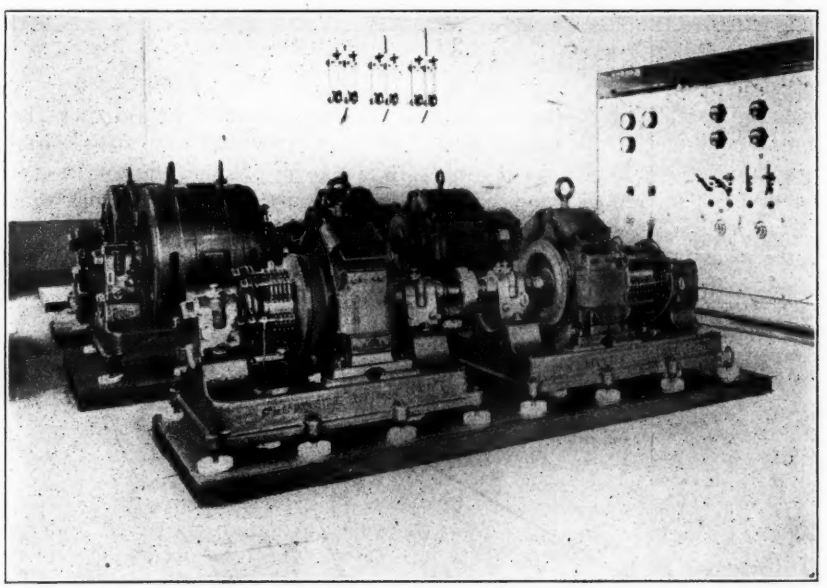
Overflow Gate, Avignonet Plant.

converter sets of 450 kilowatts each have been erected in the substation "A" at Athens.

Among the large hydraulic plants, which are located in the mountainous regions of France, in the neighborhood of Grenoble, is the Avignonet plant, situated upon the Drac river. The same stream also supplies water for the station of Champ, which has already been described. As to the Avignonet plant, the hydraulic work is of considerable importance, and owing to the position of the dam in a deep gorge in the mountains, it has been specially difficult to carry out. The dam is located at a distance of 2,800 feet from the turbine station, and the head of water which has been obtained is about seventy feet. In the rear of the dam the narrow gorge forms a vast basin containing 300,000 cubic yards or more over a length of two miles, which gives a good reserve supply. The dam is built of cement beton and is about 200 feet long and seventy-five feet high. The dam is faced with stone on each side. At one side will be observed the outlet canal for waste water and gravel. It is closed by a heavy iron gate constructed by the Bouvier firm, measuring thirty-five feet high and twenty-five wide. Above the dam opens the offtake canal, which follows along the river to the turbine station. It is cut entirely in tunnel in the rock, and has at total length of 2,800 feet and a section of 150 square feet. The galley ends at a water chamber which is located at a point above the turbine plant. A set of penstocks leads down to the wheels from this point. The net head of water varies from sixty to seventy feet, with some 7,000 horse-power available at the fall. At present four turbine groups have been installed. The turbines, one of which is illustrated herewith, have been furnished by Piccard, Pictet & Company, of Geneva. Three of them are used to drive alternators of the Creusot type, built in France, while the fourth wheel is used with a direct-current generator of the Thury pattern. The latter is used to supply current for the La Mure electric railroad. A long-distance distribution system covering a large extent of territory is supplied by the alternators, at a voltage of 26,000, which is furnished directly by the alternators which are operated on the three-phase system.

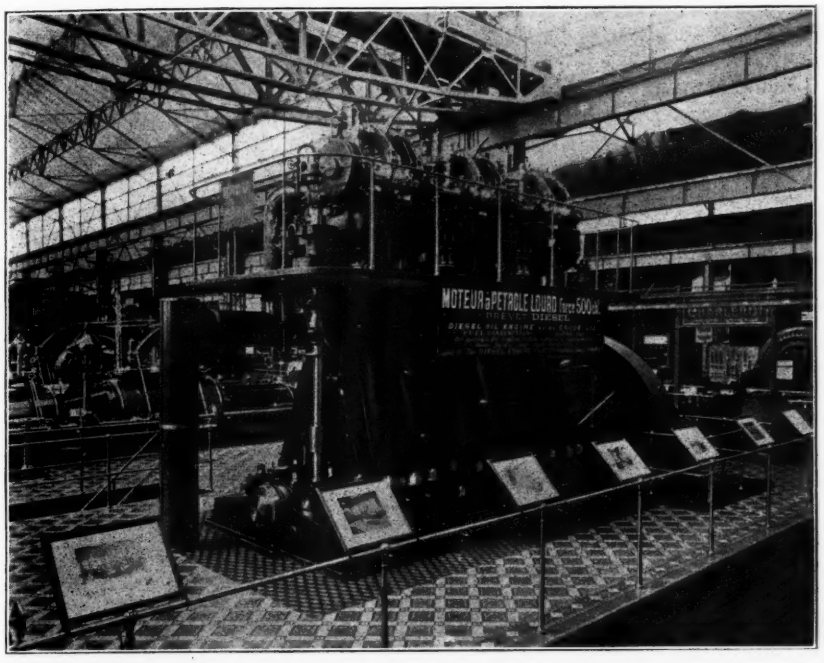
The accompanying view shows the substation which has been erected recently in order to supply current for an electric road in Switzerland which runs in the neighborhood of Vevey and Montreux on the shore of Lake Leman. This road is much used by tourists, on account of the picturesque sites which are thus reached, and it now has a good amount of traffic. Swiss material is used in the substation, and the present plant has been erected by one of the leading companies, the Compagnie de l'Industrie Electrique et Mécanique, of Geneva, which operates the well-known Thury direct-current system. Tri-phase current for operating the Vevey system is obtained from the local company from a distant plant at a tension of 4,000 volts at fifty cycles. As the electric railroad uses a working voltage of 750, apparatus had to be installed so as to convert the current above mentioned so as to supply the secondary lines. At present the station contains a number of motor-generator groups. The first series of groups consists of a non-synchronous motor of 100 horse-power, direct coupled to the company's standard type of generator. There are three of these groups installed in the plant at the present time. Another group is a positive and negative booster, which is intended to be used for regulating the voltage of a storage battery which the station contains. The battery consists of 375 cells of a capacity of 391 ampere-hours. The booster consists of a special group formed of a direct-current motor coupled to a generator which supplies a tension of 270 volts at a maximum and has a capacity of 410 amperes. This group is operated at a speed of 600 to 800 revolutions per minute.

The three motor-generator groups, which are used for converting the high-tension current of the main line, are composed in each case of a three-phase non-synchronous motor which is connected directly with the primary current of 4,000 volts coming into the station. Some 100 to 130 horse-power is given by the above motor, when running at the regular speed of 730 revolutions per minute and fifty cycles. It is of the partially enclosed type, with a series of ventilating holes, and is provided with two self-oiling bearings. The armature contains a winding placed in slots, and has a set of collector rings. Upon the shaft and connected by an elastic disc-coupler is mounted a generator of the Thury six-pole type with consequent poles. The generator is separate from the motor, and is mounted on a separate bed-plate. Porcelain insulators are used to support both these machines. In the engraving two of the groups will be noticed in the background. The generators which are used in this case are designed to receive about 100 horse-power. They furnish a current of 750 volts and ninety amperes when running at a speed of 730 revolutions per minute. On the motor side the group is found to absorb eighty-one kilowatts, while the generator furnishes sixty-six kilowatts. The booster set, which is noticed in the foreground, is designed to operate upon the circuit of the storage battery in such manner that the voltage will be kept at a constant value upon the traction circuit in all cases, during the regular run as well as in the charging of the battery, which works in parallel upon the line. In this way the number of battery cells used on the line is kept constant, and no



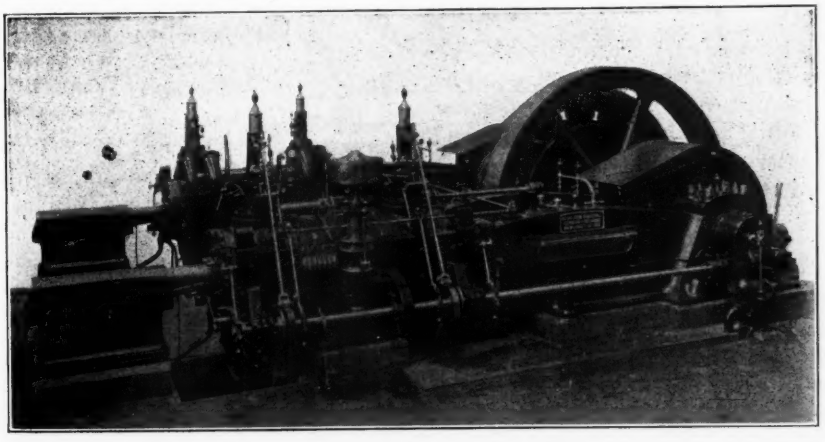
SUBSTATION, VEVEY TRACTION LINE, SWITZERLAND.

change is made in the battery connections. The booster set is made up of a direct-current Thury motor of fifty horse-power, which is run upon the 750-volt bars of the station. It operates between



500-Horse-Power Diesel Engine, Using Crude Oil, at Liege Exposition.

600 and 750 revolutions per minute. Connected to it is a generator of similar appearance, which is connected in the circuit of the storage battery. The generator is provided with an automatic regulation, and its office is to raise the voltage of the battery when the latter is discharging upon the line, or in other cases to raise the voltage of the line current when the latter is needed for the charging of the accumulators. A variable electromotive force is given in this case, as is required, and this changes from a maximum positive to a maximum negative voltage. Under ordinary conditions the generator is made to supply 150 volts, and this is raised to 270 volts toward the end of the charging operation, allowing 2.7 volts per cell of accumulator. A specially designed automatic rheostat regulator is placed in series with the generator field, so as to cause the machine to deliver the proper voltage under all conditions. This form of booster has proved very successful, and works well in all cases where it is required to operate a storage battery in parallel upon the traction line.



500-Horse-Power Twin, Double-Acting Cockerill Gas Engine and Generator.

A type of direct-connected generating group, which is meeting with considerable success on the Continent, is shown in one of the illustrations herewith. It is made up of one of the new crude-oil engines of the Diesel pattern coupled to a Lahmeyer multipolar generator. The oil engine is of the upright three-cylinder type, and is designed to give 500 horse-power. The cylinder diameter is twenty-two inches and stroke thirty inches, with a normal speed of 150 revolutions per minute. The Diesel engine is no doubt one of the heaviest of the crude-oil engines to be found in Europe. As regards the size it may be remarked that the total height, counting from the ends of the cylinder heads above the foundation-plate, is about ten feet. The cylinders and valves are cooled by water circulation. A set of specially designed oil-injectors and valves assures the proper working of the engine, and the valve mechanism has a governor connected with it, which regulates the speed between 145 and 155 revolutions per minute. The Lahmeyer generator is built upon a foundation which lies well below the floor level, so that only half of the machine is visible above the floor. It is designed for 475 kilowatts, and gives 550 volts. The outer diameter of this machine is very nearly ten feet. A set of twelve field poles is mounted upon the ring casting of the field, and contains coils wound with a 3.4-millimetre wire. The armature is of the usual drum-wound slotted pattern. On the tests the Diesel engine, which is built by Carels Brothers, of Ghent, showed a very good performance. The consumption of oil at full load is 0.412 pounds per brake-horse-power, and for half-load it is 0.420 pounds. The heat efficiency of the engine is 39.6 per cent at full load and 44.9 per cent at half-load.

A type of engine which is now coming into use for high-power units is the engine operated by low-carbon or blast-furnace gases. A few years ago such motors were constructed in small units of not more than 100 horse-power, but at present we find a number of factories on the Continent which are building engines of more than 1,000 horse-power, specially designed for use in blast-furnace plants, where they are very economical for operating blowers, dynamos and even for rolling-mills. The great advantage which could be obtained by utilizing the blast-furnace gases in the way led to the design of this type of engine. The John Cockerill Company, of Seraing, Belgium, was one of the first to build such large units successfully. Not long ago they brought out a new form of engine known as double-acting, which is much superior to the former types. At present this firm has constructed or has now in building as many as 150 large engines of the general type, illustrated herewith, giving a total of 105,000 horse-power. They are well adapted for driving dynamos, and on account of their regular running the latter can be mounted direct upon the shaft of the engine, using a heavy flywheel. The engine which is shown here is designed to give 500 horse-power, and is coupled to a multipolar generator.

THE NEW ENGINEERING BUILDING OF THE STATE UNIVERSITY OF IOWA.

BY WILLIAM G. RAYMOND.

The first section of the new engineering quadrangle of the State University of Iowa, perhaps one-sixth of the contemplated whole, has been built and occupied. This section, designed to accommodate 130 students, was known to be too small when it was begun, but the money available limited the structure to its present dimensions. As was stated in the previous article, the building is designed to be built in sections, and the next section, though much smaller than the one now built, will duplicate the study and drawing room space, and hence will provide accommodation for double the number of students.

The portion completed contains six rooms for study, drawing and recitation; one room for recitation or lecture only; one room intended for similar use, but used temporarily for the library and desk and recitation room for the senior class; a janitor's room; an executive office and faculty room; eight instructors' offices; toilet rooms; and a basement fan room.

The exterior of the building is Bedford limestone; the interior is in general of pressed brick, the walls of the corridors and some of the offices being plastered. The long corridors between the recitation rooms are well lighted during the day through glass sash, which constitutes the upper portion of the partition walls. The woodwork is oak finished in dark green Flemish style, and the furniture, so far as possible, is early English oak, the whole with the brick or tinted walls giving an effect of harmony quite generally pleasing.

The floors are of cement throughout the building, the baseboards in the plastered rooms and corridors being a combination marbolithic construction; the walls and partitions of the toilet rooms are pink Tennessee marble, and the stairways are of iron with non-slipping, composition treads.

Except the roof, which is wood covered with red tile, the entire building is fireproof; and since the ceiling under the roof is of the same concrete steel construction as the floors—made so with a view of some time adding a story—little is to be feared from fire.

The heating is by a combination of direct and indirect steam radiation, warm, tempered or cold air being forced over the building by blowers installed by the Buffalo Forge Company. No system of automatic regulation has been placed, but such a system may be put in.

The lighting is by electricity, incandescent clusters in the main offices and lecture rooms and arc lamps in the drawing-study-recitation rooms. A good many tests have been made to determine the best method of lighting; various reflectors and lamps have been tried, and further experiments are yet to be made before the most satisfactory light will be determined.

One of the chief features of the building is the furnishing, which gives each student a study desk and drawing table in a room in which, so far as possible, all his work is done. There is a recitation space with blackboards at one end of the room designed to comfortably accommodate twenty-two men, this being the largest number deemed wise to include in one section. Chairs are provided for the recitation hour. For chemistry, physics and the like, the student must go to the laboratory, but for all work requiring no laboratory demonstration, he may remain in the one room, and, during such periods as are not occupied by recitation or laboratory practice, he may study at his desk. This feature has been much appreciated by many students. The building is open from a little after seven in the morning until ten o'clock at night, and there is scarcely an hour between these limits when there are not a number of men at work at desk or drawing table.

Some little difficulty was feared in the matter of arranging sections of students so as to have the same men always in the same room, but it has been found that with a little care sections can be satisfactorily arranged. There is an occasional case when a student who is self-supporting finds it necessary to do some work with one section and some with another, but no serious inconvenience has as yet arisen with a freshman class of three sections and a sophomore class of two sections.

The arrangement of the rooms will lend itself well to the experiment that is to be tried with the incoming class. One section of this class is to be started working as individuals, each being permitted to advance as rapidly as possible and to complete his course in such time as he may find necessary. It is confidently expected that a number of the men in this section will complete the work in three years, showing great economy of time. It is also confidently expected that some men who would otherwise fail will be carried successfully through the course.

The result of this experiment will be watched with much interest, not only here in Iowa, but all over the country, since it surely means if successful a remodeling of our present methods of teaching.

During the present summer the first of the laboratories planned for the space surrounded by the main building is to be erected. This will be a steam laboratory, forty feet by eighty feet, built of brick, with saw-tooth roof construction. The plans for this structure are under way at the time of this writing.—*Transit.*

Electric Generating Equipment for a Gold Mine.

The application of electricity to the operation of gold mines has added, in no small degree, to the efficient production of the present day. The electric generating plant recently completed by the Palmer Mountain Tunnel and Power Company may be considered as a typical modern hydroelectric power installation for a gold mine. The power station is located on the Toats Coulee Creek, in the Palmer Mountains, near the town of Loomis, Washington, about twelve miles south of the international boundary line between the United States and British Columbia.

The intake of the flume, which, with the gate, is constructed of heavy material, is located a little over one mile from the power station, and consists of a heavy concrete pier abutting solid granite bedrock and anchored thereto, running out into the bed of the creek about fourteen feet. The mud sills are all six-inch by six-inch material, six feet long laid crosswise of the grade, four feet apart from centre to centre. On these sills three stringers of three-inch by four-inch material, two feet apart, are placed for the entire length of the flume and over these ties the flume bottom is laid, consisting of four two-inch planks twelve inches in width, making the bottom four feet wide. For the support of the sides, uprights of three-inch by four-inch material are set into the four-inch by four-inch ties, which are allowed to project outside of the bottom. The sides of the flume, one and one-half-inch planks, two feet high, are spiked to the uprights. On the top of the uprights across the flume is spiked a three-inch by four-inch cap, which binds this structure together. On the tangent every other tie has been allowed to project two feet beyond the bottom of the flume. From this projection to the upright, a brace is fitted in at an angle of forty-five degrees. On the curves this bracing is on every tie, thus making it impossible to rack the flume at any point. On the top of the caps a cover has been laid, which also answers

the purpose of a floor, over which all the materials for the construction were run as the building progressed. About one-half of the sills are on bedrock, the balance being on earth. Those on the earth are the only part of the work subject to decay, and can be renewed at any time without disturbing the remaining portions. Very little trestling was necessary, and what has been constructed was built very substantially. Culverts have been put in at all points where the least possible chance of damage from snow and water might occur. Overflow and safety gates are at convenient points, and three large sand boxes have been constructed to trap any grit that the water may carry during high water, thus insuring the turbine wheel against wear by sand cutting. The construction is so well made throughout that there is no leakage whatever, which is very remarkable for a flume of this length.

The penstock, which runs down the mountain side, connecting the flume with the turbine wheel, is 576.8 feet in length. Beginning at the top it is thirty-four inches in diameter and is gradually reduced to twenty-seven inches. From twenty-seven inches it is gradually reduced to twenty-four inches in diameter. The upper part is constructed of three-sixteenth-inch steel and the lower part one-quarter-inch steel. The seams are all double-riveted, while the turns are single-riveted, five-eighth-inch rivets being used throughout. It is made up in thirty-two-foot sections with steel flange joints bolted together.

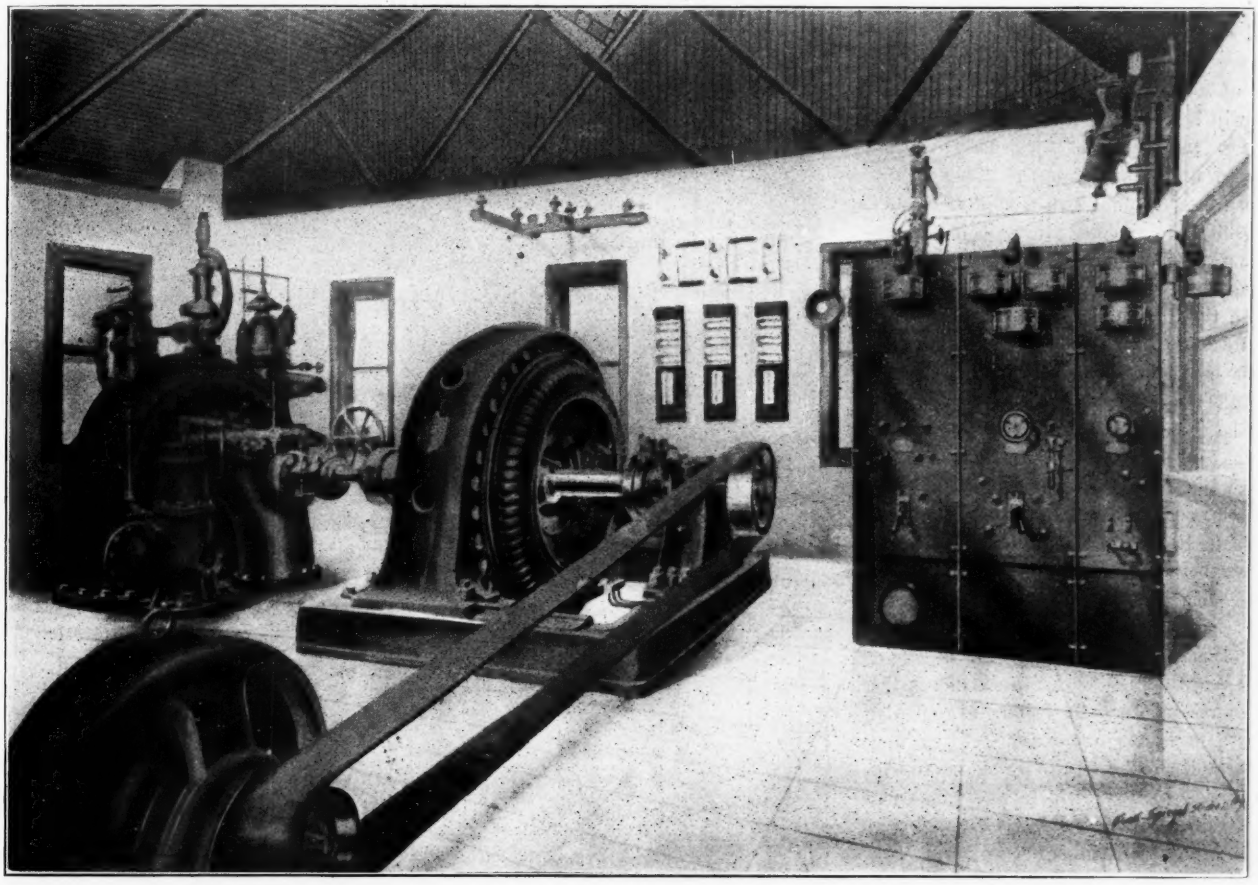
The power-house is thirty-six feet and constructed of concrete, with walls twelve inches and foundations twenty-four inches in thickness. The floor is of cement and the machinery foundations and tailrace, which extends twelve feet below the floor, are all of concrete.

The turbine is of the Allis-Chalmers type, designed especially for this installation. All of the turbine is above the floor of the power-house and the working parts are directly under the eye of the operator. The turbine has a working head of 365 feet and runs at 600 revolutions per minute.

Directly connected to the turbine is a 450-kilowatt, 6,600-volt, three-phase, sixty-cycle generator, of the revolving field type. The exciter is bolted to the shaft of the generator and also supplies electricity for lighting the power-house and the operator's cottage.

The transmission line running from the power-house to the mine is 11,554 feet in length. The poles, which are of tamarack, are forty feet in length, and are set five feet in the ground. That portion of the pole which is under ground has been treated with a creosote asphaltum preparation for preservation against decay. The wire used is seven-strand aluminum cable mounted on Locke porcelain insulators. A secondary distributing circuit for which the electromotive force is reduced by transformers to 110 volts is run from the mine to the town of Loomis. All of the business houses and many of the residences of this town are now using the current for arc and incandescent lamps. A modern 300-ton mill, equipped with automatic appliances throughout for quick and economical handling of the ores, will be installed in the near future.

Both the hydraulic and the electric equipment of the plant were supplied by the Allis-Chalmers Company, of Milwaukee.



PALMER MOUNTAIN TUNNEL AND POWER COMPANY, PALMER MOUNTAIN, OKOUAGON COUNTY, WASHINGTON. 750-HORSE-POWER SELF-CONTAINED FRANCIS SCROLL CASE HIGH-PRESSURE TURBINE, WITH GOVERNOR MOUNTED ON CASING, DIRECT-CONNECTED TO ALLIS-CHALMERS 400-KILOWATT ALTERNATING-CURRENT GENERATOR WITH EXCITER.

THE SPOKANE & INLAND RAILWAY.

SOME OF THE PRINCIPAL FEATURES, AND A BRIEF DESCRIPTION OF THE ELECTRICAL EQUIPMENT.

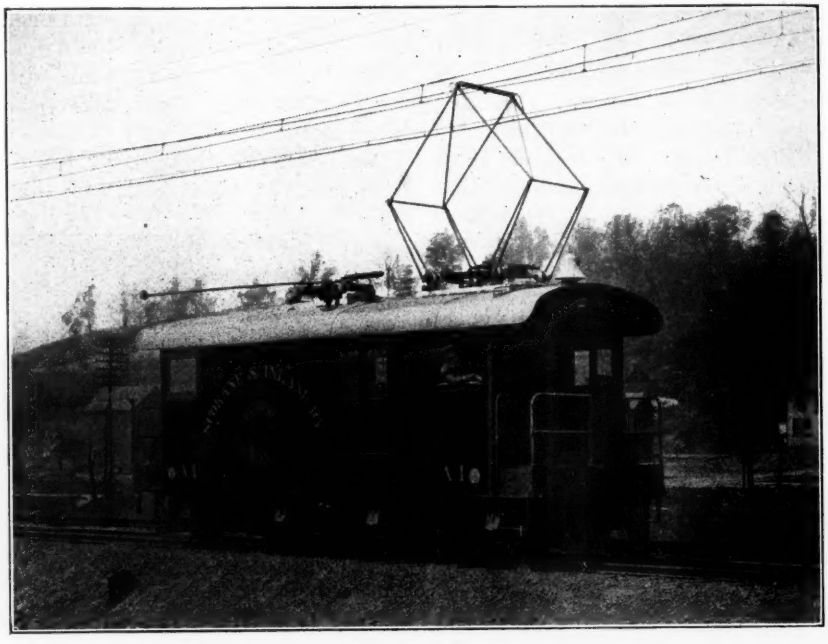
Some months ago announcement was made of a new single-phase railway which was projected to run between Spokane, Wash., and several neighboring cities, and since that time the general plans of the system have been completed, contracts for the equipment let, and the construction work is now practically finished. As this road embodies a number of entirely new features in electric railway work, an outline of some of its important characteristics will be of interest at this time.

The railway was originally incorporated under the name of the Spokane Interurban System with a capital of $3,500,000, the incorporators being well-known local capitalists. The principal terminal of the road is Spokane, from which the line runs south through Waverly, Rosalie, Thornton and Colfax, which is the southern terminus at present, although the road has been surveyed and will be eventually extended to Penawawa, Wash., or Lewiston, Idaho. A branch leaves the main road approximately midway between Spokane and Colfax, and extends to Palouse City. The Y-connected system between Spokane, Colfax and Palouse City is about 106 miles in length. The roadway and overhead construction has already been completed.

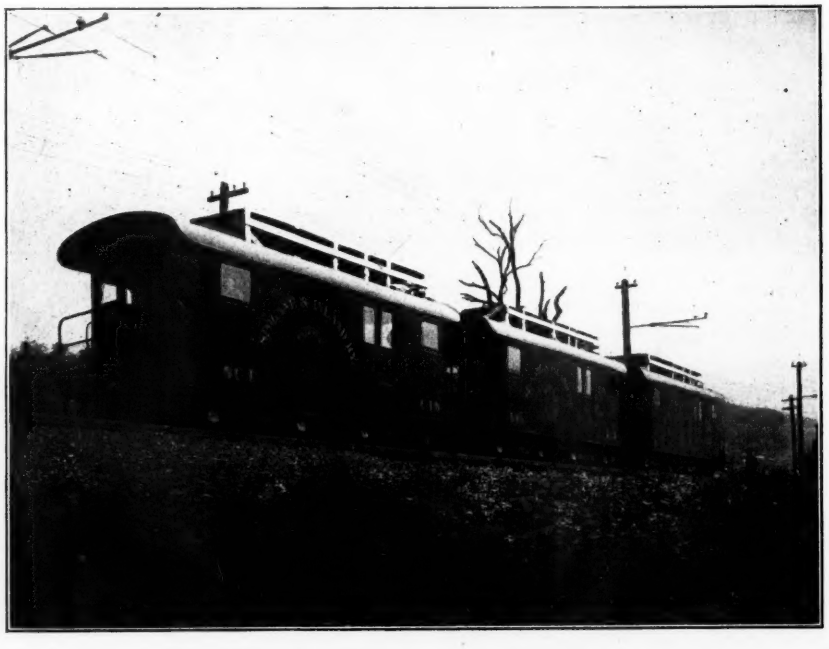
In addition to its railway business the company proposes to transmit and distribute electric current for lighting and power both in the city of Spokane and in the towns through which its lines pass. The country traversed by this road produces large quantities of wheat and fruit and is not provided with any railroad transportation. This insures a large freight business for the new road, as the long wagon haul to the steam railroads will be avoided. For this reason the electric road is receiving the hearty support of the farming interests along its route.

There are three classes of service to be maintained—passenger, mail and express, and car-load freight; and after a careful consideration of the various systems had been made, the Westinghouse single-phase, alternating-current system was adopted. The cars of the Spokane & Inland enter Spokane over the tracks of the Spokane Traction Company, which operates a 600-volt direct-current system, and this requires the use of both direct and alternating current on the interurban cars.

Power purchased from the Washington Water Power Company is used for the operation of this road. It is delivered as 4,000-volt, three-phase current of 7,200 alternations to a frequency-changing station about ten miles south of Spokane. This station will contain four motor-generator or frequency-changing sets, each of a normal rating of 1,000 kilowatts, consisting of a 1,000-horse-power, sixty-cycle, three-phase, 4,000-volt induction motor; a 1,000-kilowatt, twenty-five-cycle, 2,200-volt single-phase alternator of the revolving-field type, and a 750-horse-power, 550-volt direct-current generator which is to float on a storage battery, acting alternately as a motor and as a generator. These three machines will be mounted upon a single bed-plate and will be provided with ample bearings. There are three exciter sets for the alternators, each consisting of a seventy-five horse-power, three-phase, 4,000-volt induction



SPOKANE & INLAND ELECTRIC LOCOMOTIVE, WITH PANTAGRAPH COLLECTOR RAISED FOR OPERATING ON 6,600-VOLT ALTERNATING-CURRENT LINE; WHEEL AND ROD COLLECTOR IS USED FOR 700-VOLT ALTERNATING-CURRENT AND FOR DIRECT-CURRENT LINES.



SPOKANE & INLAND ELECTRIC LOCOMOTIVES READY FOR SHIPMENT.

motor and a fifty-kilowatt direct-current generator. A twenty-panel switchboard, electrically-operated oil circuit-breakers, and lightning protective apparatus complete the equipment of the frequency-changing station.

The 2,200-volt, twenty-five-cycle current is stepped up to 45,000 volts by means of four 1,250-kilowatt, oil-insulated, water-cooled transformers, and at this pressure is transmitted to fifteen static transformer substations. Each substation is equipped with two 375-kilowatt transformers of the oil-insulated, self-cooling type which step down the current from 45,000 volts to 6,600 volts, which is the trolley line voltage. The cars and locomotives operate under three different potentials—6,600 volts alternating current in the country, 700 volts alternating current in the small towns, and 600 volts direct current in the city of Spokane.

The trolley line is of the Westinghouse standard catenary construction with a No. 000 wire carrying 6,600-volt alternating current. The high-tension transmission lines are No. 2 copper wires.

The electrical equipment of both the passenger and the express cars is identical and consists of four Westinghouse 100-horse-power, alternating-current railway motors per car, which will maintain a schedule speed of from thirty-five to forty miles per hour. The locomotives are equipped with the same type of motors but the latter are each of 150-horse-power capacity. Both the motor-cars and the locomotives are operated on the Westinghouse multiple-unit control system.

These locomotives are designed to handle a general car-load freight business and are capable of hauling seven standard freight cars fully loaded at about thirty miles per hour on a level track. They will operate on the 6,600-volt and 700-volt alternating-current lines and on the 600-volt direct-current line. Both pantagraph and wheel trolleys are used, as shown in the accompanying illustrations, the pantagraph trolley being for operation on the 6,600-volt circuit and the wheel trolley for the 700-volt alternating and the 600-volt direct-current circuits.

The cab of the locomotive serves to enclose the auxiliary apparatus and is constructed entirely of steel. Its total weight is forty-nine tons and its length over bumpers is twenty-nine feet. It has two swivel trucks with thirty-eight-inch driving wheels, and two motors are mounted on each truck and are geared to the axles.

Both straight and automatic air-brakes are used, the compressed air for which is supplied by two Westinghouse Air Brake Company compressors, each driven by a five-horse-power Westinghouse single-phase motor.

The motors are arranged in two groups, each group consisting of two motors connected permanently in series; so for the purpose of control these groups may be considered as single units in a two-motor equipment. Two auto-transformers are used in the locomotives and an automatic overload and no-voltage circuit-breaker is placed between the trolley and the transformers, which operates on either overload or no-voltage by breaking the current supply to the control magnets, thus automatically opening all the switches. This circuit-breaker must always be closed by hand, and it will not stay closed unless the trolley is up and current is on the line.

When the circuit-breaker is thrown in the circuit is completed through the auto-transformers to ground. A commutating switch is automatically shifted to the alternating-current position, and the small transformer furnishing current to the control system is cut into circuit, leaving the locomotive ready to start.

The unit switches are essentially similar to those used on direct-current systems. The control magnets are of the alternating-current type wound for 200 volts and operate on about eight volts direct current, but in both cases will operate down to about one-half voltage. These magnets serve to admit air under heavy pressure to the cylinders which operate the unit switches.

These switches are assembled into a compact unit known as a switch group and the group is protected by an iron case, in which it is mounted, from the severe exposure to which a locomotive or a street-car equipment is subjected.

Interlock contact blocks are provided which make it impossible for a switch to close or remain closed unless all the other switches operate according to their predetermined cycle. This assures the proper order of switch operation.

The alternating current for the operation of the magnets by the master controller is obtained from the secondary of a small transformer which is connected to the 500-volt point of the main auto-transformer. When operating on direct current a resistance is placed in series with this auxiliary transformer across the 600-volt mains, and direct current is taken from a suitable tap on this resistance. This dispenses with the use of a storage battery for direct-current operation.

The only mechanical operation in changing from alternating current to direct current is to change the trolleys; the control is changed automatically by the commutating switch, which is a small pneumatically-operated drum for shifting the control circuits. This drum is operated by a magnet connected directly to a 200-volt tap on the main auto-transformer and has no direct-current connection. The switch has one position for direct-current operation and another for alternating-current operation, and it can not be thrown to the alternating-current position unless alternating current is flowing through the magnet coil. If it should remain in the direct-current position no harm would be done.

The reversing switch is similar to the commutating switch in its operation but is furnished with two magnets and air cylinders, one for each position.

The preliminary order on this contract specifies fifteen passenger cars, six express cars and six locomotives.

Extension of Southern Power Company's System to Concord, N. C.

The Southern Power Company now furnishes light to the city of Charlotte and also the power to operate a number of manufacturing plants there, among these being the Highland Park mill, two miles north of Charlotte. The town of Concord is only eighteen miles further on and lines are to be run to enable the company to operate there. The work on the survey will commence at once and it is expected that within eight months from this time many spindles in Concord will be turned by Catawba river power. Two thousand horse-power is needed for this purpose to begin with, and the Odell mills will need 1,500 of that. It is understood that J. W. Cannon agrees to take this power also to operate some of his mills.

Dr. W. Gill Wylie and Chief Engineer W. S. Lee, of the Southern Power Company, were in Concord recently making contracts with presidents of factories and other plants to be operated by the Southern Power Company. Recently the Odell Manufacturing Company opened negotiations with the power company, resulting in the visit of Dr. Wylie, who virtually made a contract with the Odell Manufacturing Company to furnish the 1,500 horse-power necessary to operate its mills.

Independent Telephone Officers Elected.

The Vermont & New Hampshire Independent Telephone Association, at a recent meeting held at Woodsville, N. H., elected the following officers: president, H. W. Buchanan, Barton Landing; vice-president, O. E. Eaton, Woodsville, N. H.; secretary, G. W. Buzzel, St. Johnsbury; executive committee, H. W. Buchanan, O. E. Eaton, G. W. Buzzel, F. C. Gleason and D. L. McGuire.

SOME NOTES ON THE MECHANICAL EQUIPMENT OF COLLIERIES.[1]

BY E. M. HANN.

At the Bargoed colliery of the Powell Duffryn Steam Coal Company the boiler power consists of sixteen Babcock boilers, 180 horse-power rated, 1,826 square feet heating surface, each with its own superheater, the steam pressure being 120 pounds and the average superheat ninety degrees Fahrenheit. At an early stage, about 1898, it was decided to work all the smaller machinery on the surface by electricity, and a Marshall compound engine of 300 horse-power, with three 100-horse-power dynamos, were installed for the purpose, which supply at present about forty-one motors, ranging from one to fifty horse-power and aggregating 453 horse-power. Latterly an alternating plant for larger work and for underground haulage and pumping has been installed, of which some notes will be given further on.

One disadvantage frequently found in colliery arrangements is noticeable here, namely, the distances to which steam has to be carried to the various engines, and the narrowness of the site in this instance considerably increased that bad feature. The introduction of electric power will greatly modify this, by enabling the necessary power for subsidiary engines to be conveyed by wires instead of by pipes. In illustration of this the Powell Duffryn Steam Coal Company's electric installation at Aberdare has caused the removal of 2,830 yards of steam mains of all sizes, from twelve inches downward.

On the subject of electric winding, the author can not add much, but his view is that, in case of deep shafts and heavy loads, the difference in the economy of the engines can not repay the following disadvantages: either the size of the generating sets required at a colliery must be greatly modify this, by enabling the neing engine in the electrical equipment, or some storage or equalizing system must be introduced, which adds greatly to the capital cost and the complication of machinery, and is itself a source of waste. Whereas 750-kilowatt sets might be very suitable for the hauling and other machines if an electric winding engine be added, which runs up to 2,000 horse-power, it becomes necessary to have a 3,000-kilowatt set and in duplicate unless the balance be introduced.

The mode for unloading adopted for the Penalltau pits of the same company is on generally similar lines to many others in use; the floors of the cage upon which the empty trams stand are raised from a horizontal to an inclined position by a compressed-air cylinder, the cage floors being similarly inclined when dropped upon the keps, star wheels being untrigged and letting out the full and arresting the empty trams. The upper of the two decks is the main pit-top level and the empties are dropped to the lower one by a balance lift, while the lower ones are brought up from it by a creeper chain driven by an electric motor.

The more usual practice at collieries is to get the pit top at the same level as that at which the coal is tipped into the wagons, and in many instances very considerable expense has been incurred to accomplish this object. In this case it would have added very greatly to the cost of the engine houses and workshops and instead of doing so the pit-top level was fixed at the most economical level in first cost, and the trams containing coal and rubbish are taken up an incline of one in six, ninety feet in length, to the level convenient for the tipping and screening plant, the power being got from a ten-horse-power motor, geared down, and driving a slow-moving creeper-chain on to which the trams pass and are taken by it to the top level where they release themselves.

It was considered advisable to delay the introduction of electricity on a large scale, until the colliery was more fully developed, and an air-compressor was provided to supply power below ground for haulage.

Bargoed was chosen as the most suitable place for central engineering shops for this group of collieries and a fitting shop, smiths' shop, foundry and pattern shop have been erected a quarter of a mile away from the colliery buildings. The various machinery at these shops is also driven by electricity derived from the continuous-current system already mentioned.

In the new pits to be sunk at Penalltau, it is proposed to use electrical centrifugal pumps for dealing with the water during the sinking of the shafts. The pumps, which are to be employed raising the water from the shaft bottom, will be vertical, and will be suspended on steel-wire ropes running from an electrical winch on the surface, the rising main being also carried on the same ropes, so that the whole can be raised or lowered as required. These pumps are to be capable of raising 35,000 gallons per hour 120 yards high, and the motors, which are to be totally enclosed and watertight, will be cooled by the water being conveyed in pipes around the coils of the motor. When the head gets excessive for these pumps, larger horizontal pumps will be fixed in the shafts, up to which sinking pumps will have to deliver the water. Should water persist down to the same horizon in the strata as at Bargoed, the lift will be 700 yards and will be divided into two of 350 yards each, and permanent pumps placed at these levels.

To minimize the effect of stoppages of any of the electric plant, this colliery is connected by a transmission line with the system supplying the company's two collieries lying northward, that is, the Elliot colliery, one and three-quarters miles distant, and New Tredegar, one and one-quarter miles north of Elliot colliery, where, at the Elliot collieries, there is a 750-kilowatt set generating at 3,000 volts, fifty cycles, three-phase, and further, is provided with a motor generator of 300 horse-power, capable of converting from alternate to continuous current or *vice versa*. At the Elliot pits there is also being erected an exhaust-steam-utilization plant, which will use the steam exhausted by the two large winding engines there, and a Rateau turbine and generator of 500 kilowatts to run in parallel with the 750-kilowatt set. The electric power was put in particularly to reduce the requirements of compressed air, which were becoming too heavy for the existing plant, and because it could supply Bargoed temporarily until that place got its own gas-driven plant erected, and also as a permanent reserve. Seven important underground haulages and some pumps are already at work from it, and more will be added as soon as the gas-driven generators are started, and the demand from Bargoed is relieved or the Rateau turbine started. There are two aerial ropeways in use, both very short; one is for the removal of the rubbish unavoidably raised from the mine and that washed out of the coal, which, for want of other space, has to be taken up the hillside, and the other is for transporting the coal from the washery to the coke ovens.

As previously mentioned, there is an electric installation at the company's Aberdare group of collieries, which is on the same lines electrically, that is, 3,000 volts, fifty cycles, three-phase, and is centrally situated so as to supply seven collieries, with the probability of adding two more. This was mainly to replace old steam machinery with long ranges of pipes and compressed-air power. A full account of it has been published in a paper by C. P. Sparks, which was read before the Institution of Electrical Engineers, and the author will therefore only say that for a

[1] Abstracted from a paper read at the recent meeting of the Institution of Mechanical Engineers of Great Britain.

plant involving the removal of old machinery, and consequently a much larger ratio of capital to power than in a new installation, it has yielded very satisfactory results, though not by any means the phenomenal savings frequently claimed for this mode of transmission. There are, however, several important advantages which it is not possible to put into figures, such as these: the savings are far greater *pro rata* when the collieries are idle than when at work, and it removes one great restriction upon the location of any power that may be needed in the future. A colliery plant suffers from the same drawback experienced in so many cases, the day load is greatly in excess of the night load; ventilators do not assist this, and pumping is about the only thing on a large scale that is available. In the case of the Bargoed and Elliot collieries, where there are large quantities of water to be pumped, it is proposed to pump the whole of the water by night by means of centrifugal pumps placed underground, which will greatly improve the load-factor of the power station.

The Cosmopolitanism of Science.

Science and commerce, which are closely interrelated under modern conditions of keen competition, both owe one feature of their development to our present state of civilization, namely, the broad cosmopolitan spirit which makes little of the accident of geographic position. In the British engineering world, says the *Engineering Times,* of London, the summer of 1906 will be looked upon primarily as a "visitors' year." Hardly have the guests—American, German, Italian and Swiss—of the Institution of Electrical Engineers completed their tour around our factories and electricity supply stations when their place has been taken by the guests of the Iron and Steel Institute —the American Institute of Mining Engineers. Civic and social festivities in London alternated with international discussions in the lecture theatre of the Institution of Civil Engineers. We say international, for in addition to the American delegates, the leading continental metallurgists are members of the Iron and Steel Institute, and papers were contributed by Messrs. F. Osmond and G. Cartaud, of Paris; by Monsieur Ph. Bonvillian, also of Paris; by Herr K. Reinhardt, of Dortmund, and by Professor H. Hubert, of Liège.

As compared with the noted conferences and councils of mediæval Europe, such meetings as these are of striking interest. Previously, international gatherings were either those of diplomats negotiating treaties and apportioning kingdoms, or of prelates settling dogmatic questions of faith. The merchants' and other mediæval guilds had quite enough to do in propitiating their local rulers. Trade secrets, moreover, were closely guarded. The isolated scientist, primarily an alchemist, did indeed migrate from land to land. Not, however, for the purpose of frank interchanges of views and discussions of methods with his rivals (for jealousy exceeded knowledge), but for the purpose of securing the favor of princes and the gold which his blind gropings in chemistry did not provide.

But iron has superseded gold in its value to the race, and its transformations, when alloyed in certain proportions with other metals, and subjected to certain heat treatments, surpass in value all that the old alchemist could hope to obtain. Indeed, were the transmutation of gold from commoner metals an assured fact to-morrow, it would, after a period of financial upheaval, merely result in the selection of another token for exchange purposes.

The spirit of the alchemist rested for many years upon the workers in other metals. Mr. Hadfield, in his presidential address last year to the Iron and Steel Institute, pointed out that a writer in 1557 spoke of the heating and quenching of steel "three or four times in equal parts of extract of radishes and water which had contained earth worms." With such views solemnly put on paper only 350 years ago, it is indubitable that a number of secret and special processes of various localities were attributed to jugglery of the extract of radishes and earth worms order, while the reason for special repute often lay in some then unknown particular constituent of the one used.

We have not the space for a lengthy disquisition upon changes of mental attitude to scientific problems, but would note in passing that the domain of law ruling through every sphere of nature and of manufacturing art, mystic incantation and haphazard quackery have disappeared. In their place rests the insatiable desire to ascertain the laws governing every phenomena within our acquaintance. Nobody believes in secret processes, for there are none of a chemical and few of a physical character which would prevent the production of a similar product by an intelligent firm, none of whose stuff had the slightest inkling of their rivals' methods. Everything is a matter of law, and the answer from a scientist that such and such a method is insoluble in our present state of knowledge merely means that our known laws and proved hypotheses do not fit the case, and that by experiment other hypotheses will be advanced and, if not disproved, be accepted as laws.

Confronted by such immense problems, the first step has been for individual workers in different countries to band together for concerted study. The second step has been for international cooperation, for the problems are too many for any one tribe of the human race.

We commenced by saying that science and commerce were both sharers in a spirit of cosmopolitanism—commerce, because of the interchanges necessary in the barter which exchanges manufactures for foodstuffs, clothing and luxuries; and science, because of the necessity of concerted work in endeavoring to express phenomena in terms of the appalling number of unknown laws confronting it.

A 50,000-Volt Transmission for Seville.

A scheme which is in progress for supplying the town of Seville from a generating station at El Carchado, about eighty miles from the town, by means of a three-phase transmission at 50,000 volts, is described in a European contemporary. Three 1,500 horse-power turbines, running at 400 revolutions per minute, will form the first instalment of generating plant, and these will drive alternators, generating at 5,000 volts forty cycles. In order to step up to the line voltage, seven single-phase 600-kilovolt ampere transformers will be provided (one as spare), and another group of transformers in the substation at Seville will reduce the pressure to 3,500 volts. The work is being carried out by the Spanish Oerlikon Company.

Submarine Telephone Tests.

A dispatch from Berlin, Germany, dated August 9, states that experiments began on that date at Lake Constance with a submarine telephone cable constructed under Professor Pupin's system. The cable connects Friederichshafen on the north shore of the lake in Wurtenburg, and Romanshorn on the opposite southern shore in Switzerland, about seven miles distant, the cable reaching a maximum depth of 820 feet. The cable was laid by the Siemens & Halske Company for the Bavaria, Wurtenburg and Swiss telegraph departments.

Electrochemical Papers Before the American Chemical Society.

At the recent meeting of the American Chemical Society, held at Cornell University, Ithaca, N. Y., several papers on electrochemical topics were read. They are noted below.

"The Electrical Conductivity of Solutions of the Alcohols in Liquid Hydrobromic Acids." E. H. Archibald. The conductivities of solutions of some fourteen of the alcohol bodies have been measured quantitatively over a considerable range of dilution. The molecular conductivity in nearly all cases increases rapidly with the concentration. As far as these investigations have extended, those bodies which dissolve conduct the electric current.

"The Electrical Conductivity of Solutions of the Organic Acids in Liquid Hydrobromic and Hydrochloric Acids." E. H. Archibald. As far as can be ascertained, those acids which dissolve to any extent give solutions which will conduct. The hydrochloric acid solutions have by far the greater conducting power. The molecular conductivity for both solvents, except in a few cases for the very dilute solutions, increases with the concentration.

"The Electrode Capacity of Iron and its Bearing on Passivity." C. McC. Gordon and Friend E. Clark. The most commonly accepted explanation of the passivity of iron is that it is due to a very thin oxide sheet, the passive iron acting as an electric condenser; the conducting iron and the conducting solution being separated by insulating oxide, similar to films on aluminum anodes. Measurements of this capacity—comparing it on the Wheatstone bridge with a metallic condenser of known capacity—have been made for iron electrodes in various solutions, with the following results: (1) Passive iron (electrodes) acts as if covered with a sheet of oxide, as is evidenced by the following facts: (*a*) The electrodes have a capacity easily measured while active electrodes (that is, iron in dilute nitric acid or freshly deposited electrolytic iron) show no signs of such capacities. (*b*) The capacity values are about of the same order of magnitude as those of aluminum, where we certainly know there is such capacity. (*c*) Electrodes oxidized in a Bunsen burner flame give a similar capacity. The oxidized sheet, so formed, appears to be five or six times as thick as that of the electrodes made passive by the concentrated nitric acid. It is notably different, too, in that it has a small resistance. It acts like a leaky condenser, or a condenser in parallel with a resistance. (2) Iron transferred from the air to neutral solutions behaves qualitatively exactly like iron oxidized in the flame. Its capacity, however, is somewhat larger than that of the passive iron, indicating a thin film or sheet. The resistance of this sheet is relatively smaller, due, probably, to small holes or crevasses in the sheet.

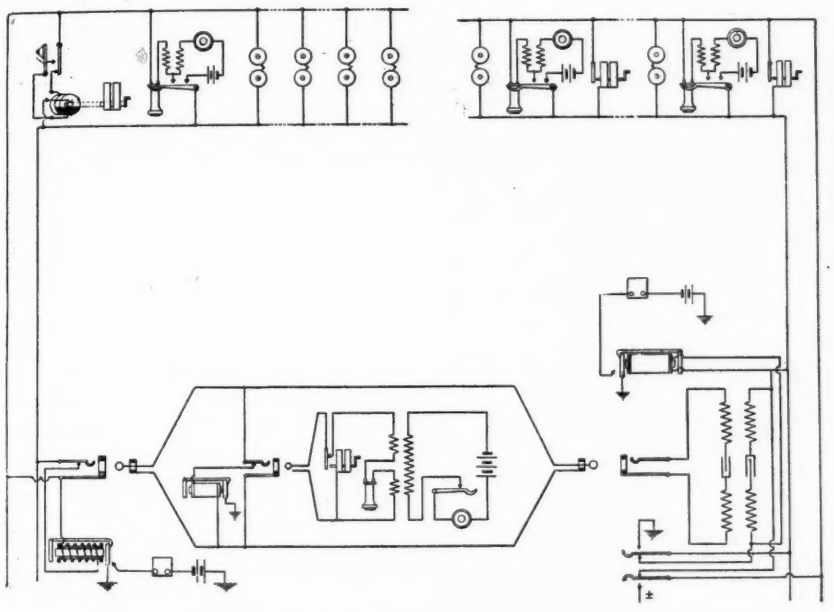
"The Electrical Conductivity of Tungstate Solutions." Roger Clark Wells. A study of the conductivity of various tungstates showed that in the case of sodium metatungstate and ammonium paratungstate a partial transposition begins to take place as soon as those salts are dissolved in water. Although the rate of this transformation is very slow at twenty-five degrees centigrade, it increases rapidly with rising temperature. This fact will undoubtedly explain the queer solubility determinations which several investigators have found for these salts without considering the time factor.

Greenock, Scotland, Electricity Works Extensions.

The municipal electric power system of Greenock, Scotland, possesses some interest since this town was one of the first to install such a plant. As far back as 1883 a provisional order was obtained by the municipality with a supply of electricity within a small area. Greenock possessing the questionable distinction of being the wettest town in Great Britain, it was but natural that the town council of that territory should have turned its attention to water power, and the first installation, which was erected the latter part of the year mentioned, consisted of a 140-horse-power water turbine driving four generators of the old Gramme ring type. A few public lamps were installed, in order to show the possibilities of the new illuminant, but the only important customer appears to have been a neighboring sugar refiner. The supply pressure was 100 volts, and, as there were no other large consumers near the station, the cost of distribution was prohibitive. After a considerable amount of money had been spent the station was shut down. The matter was not taken up again until 1897, when the company proposed appealing for powers to supply electricity. The council was, therefore, obliged either to hand over its powers to the new company, or to restart the work itself. The latter plan was adopted, and plans for a station to cost $165,000 were drawn up. The station was built and equipped and the supply of current restarted in the fall of 1899. The equipment at this time consisted of three steam dynamos with a total output of 400 kilowatts and a storage battery. Supply mains were laid on the solid system. At this time the British Electric Traction Company acquired interest in the old horse-car system and applied for a renewal of the lease which was about to expire. This was done on condition that the energy necessary for working the tramways should be purchased from the corporation, the minimum guarantee being 500,000 kilowatt-hours per annum at the rate of three cents per kilowatt-hour. In 1901 two additional generating sets were installed to meet the demands of the tramway company. A further addition to the plant was soon made in the form of a 300-kilowatt generator. In 1903 a controversy arose between the corporation and the tramway company regarding the price to be paid for energy in excess of the guaranteed amount. The arbiter, a lawyer, reduced the price of the excess energy to one and one-half cents, bringing down the average of the whole supply to two cents per kilowatt-hour. The immediate result was a serious deficit in the financial returns of the undertaking, as the award was retrospective. To meet the new conditions, prices were reduced for both lighting and power purposes, a condensing plant was installed and a system of free wiring and hiring out of motors was begun to encourage and popularize the use of electricity. The result was the brisk demand for power from the local ship-builders and engineers, and the lighting business made steady headway, with the result that the output of the station doubled itself in a short time. The motors installed rose from 670 horse-power at the end of 1903 to 3,100 horse-power in 1905. The equivalent number of eight-candle-power lamps jumped from 42,000 to 85,000 during the same period. Notwithstanding the reduced prices, the plant showed a surplus of $8,000 last year. The plant at present consists of two 400-kilowatt, two 300-kilowatt and two 150-kilowatt steam dynamos. There are one 200-kilowatt and one 100-kilowatt steam balancers, bringing the total rating of the plant up to 2,000 kilowatts. In addition to the above, there are two batteries, one for lighting with a normal rating of 400-kilowatt-hours, and one for the railway system having a rating of 450 kilowatt-hours. Although at the time the latter was installed the traction allowed was only about three-eighths of the total output of the station, the result of putting the battery into service was to bring down the coal consumption from six and one-quarter to five pounds per kilowatt-hour generated. The average traction load was about 360 amperes and the maximum 1,000 kilowatts—*Electrical Review* (*London*), *August* 3.

Electrical Patents.

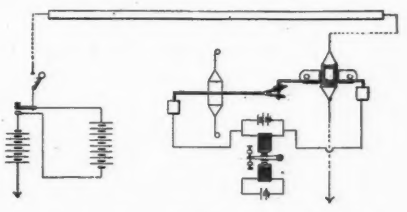
Charles E. Scribner, Jericho, Vt., has obtained a patent (828,061, August 7). for an improved telephone exchange system, which he has assigned to the Western Electric Company, of Chicago, Ill. This



TELEPHONE EXCHANGE SYSTEM (SCRIBNER).

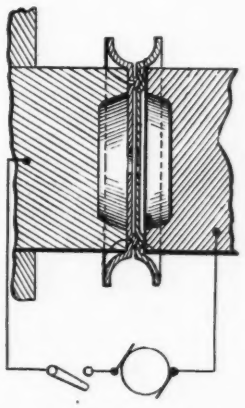
invention relates to a telephone exchange system, and has for its object to provide an improved system, wherein telephone lines on which toll is to be charged for each use may be interconnected or connected with lines of other types and the subscriber of one of the connected lines prevented from signaling the subscriber of the other line without the intervention of the central operator, so that the operator may keep an accurate check or supervision on the number of conversations which any line may have with another. In a telephone exchange system embodying the invention, a telephone line extends from a number of substations to a central office, a call indicator being associated with the line at the central office. At each of the substations of the line is provided signaling mechanism adapted to signal any one of the other substations of the line without affecting the central office call indicator and a device is also provided at each station adapted to cooperate with the signaling mechanism thereat to actuate the call indicator at the central office without disturbing or signaling the other substations on the line. Another telephone line extends from one or more substations to the central office, and the operator is provided with means for connecting the lines together for conversation. When the lines are connected by the operator, a device is interposed between them which is adapted to permit the passage of telephonic voice currents, but to bar signaling currents, so that while the subscribers of the connected lines may converse with one another they are not able to signal each other. The operator is provided with means for applying ringing current directly to either line, and after a conversation is finished between the two connected lines a subscriber of one line can not signal a subscriber on the other line and obtain another conversation without the intervention of the central office operator, who is thus enabled to keep an accurate check on all conversations for the purpose of charging toll.

Isidor Kitsee, Philadelphia, Pa., has obtained a patent (827,916, August 7) for an improved submarine telegraph system. This invention relates to an improvement in submarine telegraphy; but it is also applicable to long-distance telegraphy on land. The object of the invention is to supply the submarine cable with a device with the aid of which sounders or other electromagnetic devices may be actuated, and incidentally thereby to increase the receiving capacity of the cable. The invention consists of means to relay a telegraphic receiving device, embracing the receiving device proper, a mechanical relay provided with contacting means, adapted to move in unison with the movable part of the receiving device, a local circuit containing one coil of a translating device, a second local circuit containing the second coil of the translating device, a shunt for one of these coils, one terminal of the shunt connected electrically with part of the receiving device, the second terminal connected with part of the relaying device, and means whereby through the contact of part of the receiving device with part of the relaying device, the shunt-circuit is closed.



SUBMARINE TELEGRAPHY (KITSEE).

An improved process of electric welding has been invented by Laurence S. Lachman, New York, N. Y. (828,033, August 7). The invention relates to an improved process of electric welding for welding two sheets of metal together. The invention may be applied to the construction of pulleys, wheels, sheaves, pulley frames, and other structures whereby parts may be securely united to each other without the use of rivets, bolts, keys and without interlocking connections. The invention consists of a process of electrically welding one piece of sheet metal to another, and which consists in providing projecting portions upon one of the sheets of metal and depressed portions on the other of the sheets of metal, placing one sheet of metal upon the other with the projecting portions of one in contact with the depressed portions of the other, passing a current of electricity through the sheets of metal and through the cooperating projections and depressions, thereby fusing the portions, and simultaneously forcing the two sheets of metal together to securely weld one to the other.



METHOD OF ELECTRICAL WELDING.

Reviews of Current Engineering and Scientific Literature.

Magnetic Testing for Faults and Gas Bubbles in Iron.

A simple method of testing sheet iron for faults and air bubbles is described by Herr L. Kann. This consists in making use of the change in permeability of the material produced by such a fault. The iron is passed over the poles of an electromagnet and a small test coil is placed either on the tip of the magnet poles or on the other side of the sheet of iron. In the first instance, a fault passing over the poles changed the leakage lines by alternating the permeability of the magnetic circuit. With the latter arrangement, a similar action takes place, changing the number of magnetic lines which pass through the sheet and into the test coil. This change in permeability sets up a secondary current in the test coil, thus producing a galvanometer deflection.—*Translated and abstracted from Physikalische Zeitschrift (Leipzig), August* 1.

Oils for High-Tension Switches.

Some extended tests of oils used for high-tension oil break-switches have been made by J. H. Bolam. He here describes his method and gives some of the results. The requisites of a good oil for such use are as follows: It should have a high insulation resistance; it should be capable of quickly extinguishing the arc; it should be free from acids or other compounds liable to corrode the switches; it should not gum; it should be as fluid as is consistent with a quick extinguishing of the arc; it should have a high flash point, and it should be transparent. The method of testing consisted in determining the breakdown point of thin layers of oil between small terminals. An alternator was used for this purpose, the necessary high potential being secured by a step-up transformer and the regulation being effected by first lowering the potential to a fairly low value so that a convenient amount of resistance might be employed. Nearly all oils are good insulators when pure, but the action of the arc alters the aspect, for some of them are decomposed. Castor oil has a high insulating value, but does not extinguish the arc. The oils used for switch work are generally mineral or resin oil, but the latter has fallen into disfavor recently. The insulation properties of the two oils are similar, the resin oil being possibly slightly the better. As a general thing, a mineral oil should be used, because in the preparation of vegetable and animal oils chemicals must be used which are apt to leave undesirable materials in the oil. Tests show that the highest insulation resistance was given by a resin oil. Then followed several mineral oils, the one having the lowest flash point being the best. An ordinary mineral engine oil gave fairly good results, the breakdown voltage being 18,000 for a spark-gap one-sixth of an inch. The resin oil, with the same spark-gap, required a breakdown voltage of 32,000. This resin oil was in every way the most satisfactory of all the oils tested.—*Abstracted from the Electrician (London), August* 3.

The Positive Charge Carried by the α Particles.

It was suggested some time ago by F. Soddy that the α particle was initially uncharged on expulsion and that it gained its charge subsequently by collision with atoms in its path. This suggestion is based on the work of Bragg, who showed that the α particle passes through rather than collides with the atoms of solid or gaseous matter in its path, and that whether uncharged or not initially, it must equally with the atom struck become charged positively after the encounter by the detachment of a negative electron. Recently, P. Ewers, employing for this purpose polonium, attempted to put the idea to an experimental test, but with negative results. Bragg, however, pointed out that Ewers' experiments did not settle the question, and he evidently believes that it can not be settled experimentally. The requisite conditions to be fulfilled for a positive result are held to be so rigorous that no one could be certain that they had been fulfilled, and it is impossible to disprove the view by a negative result. But it is obvious that a positive result would settle the question, and the author has made a number of experiments in the endeavor to obtain such a result. After a long experience of negative results, one at last seemed to give an indication of a positive result. The conditions under which this had been conducted were carefully examined, and the experiment was finally conducted in such a way as to give definite positive results. The method of the experiment consisted in allowing the α particles upon expulsion to pass through a capillary tube. This tube and the tube containing the radioactive matter were highly exhausted so as to give a fairly long path of travel before a collision took place. A magnetic field set up across the capillary tube would then cause the particles to be deflected and to collide with the tube if they carried a charge. If, on the other hand, they were uncharged, the path of the discharge would remain unchanged whether the field were present or not. Another requisite was that the film over which the particles were expelled should not be more than one molecule thick. The experiment consisted in arranging the apparatus so that the rays were completely deviated by the magnetic field when charged, but passed through the tube unaffected when a high vacuum was secured. It was noticed that during the tests, the inner walls of the tube darkened, due it was thought to the collision of α particles. The radioactive material used was radium C. The author believes that there is no doubt that the α particle emerges uncharged. If so, it would appear that the influence of electricity in radioactive change and its importance generally in its relation to matter could be overestimated. — *Abstracted from Nature (London), August* 2.

Propulsion of Vessels by Irreversible Engines.

A novel scheme for propelling vessels due to Monsieur C. Del Proposto is discussed at some length here by Monsieur A. Lecointe. In brief the plan contemplates using Diesel engines, connected to the propeller shaft by a clutch. The engine shaft, in addition, contains a dynamo, while on the propeller shaft there is a motor, having a normal rating of about one-half that of the engine. The object of this arrangement is to give the engineer control over the speed of the propeller and over the direction of rotation, thus enabling him to manœuvre the vessel. For steady running, after the propeller has been brought up to full speed, the coupling is thrown in gear and the electrical connections opened, the engine driving the propeller directly. Besides the advantages, mentioned above, gained through the use of the electric drive, this plan also makes it possible to put the control of the driving mechanism in the hands of the steersman. The advantages of the drive are given as follows: a number of propeller shafts may be adopted, power to any one of which may be supplied from any generator. Each propeller is under individual control, making manœuvres rapid and even possi-

ble should the rudder be disabled. The motors may be controlled from any part of the vessel. An important question is whether Diesel engines can be constructed of sufficient power for large vessels. At the present time engines of this type, having four cylinders each rated at 250 horse-power, have been constructed. This gives 1,000 horse-power per engine, and by using three propellers we obtain 3,000 horse-power. Attaching two engines to each propeller shaft, this figure is doubled. By operating the engines on the two-cycle, instead of four-cycle, principle, and by making them double-acting, each engine may be rated at 3,000 horse-power, thus making 18,000 horse-power available for a triple-screw equipment. The article then goes on to discuss several installations of this system, one on the steamer Sarinat and one on the Barndale. The former has two propellers, two engines rated at 180 horse-power each, two dynamos rated at 125 kilowatts and two motors rated at 112 kilowatts each. The latter vessel has three propellers and three driving sets. The engines are rated at 120 horse-power, the dynamos at eighty-seven kilowatts and the motors at seventy-five kilowatts.—*Abstracted from the Bulletin Société Belge d'Électriciens (Brussels), July.*

The Nature and Origin of Volcanic Heat.

The hypothesis that the interior of the earth, while in the main solid, has cavities containing melted matter which occasionally is forced out in the form of eruptive outbursts, does not seem probable to Dr. Elihu Thomson, and the hypothesis of a molten or more or less fluid interior of the earth has practically been abandoned. Nor does the recently proposed theory which attributes the energy causing volcanic outbreaks to radium satisfy Dr. Thomson. He holds there is no need of recourse to an assumption of the existence of large localized bodies and radium minerals to explain such action. To say the least, such an assumed store of this rare element is improbable. The idea which he advances here seeks the expansion of volcanic action in the great and unequal pressure brought to bear at certain points. Primarily, it will be admitted that any substance, gas, liquid or solid, upon which work is done acquires heat in proportion to the energy expended upon it, which heat, if prevented from escaping, at once results in an increase of temperature of the substance. If air at ordinary temperature under high pressure escapes through a tortuous or frictional passage, surrounded by a good heat non-conductor, it emerges hot. The higher the pressure and the greater the friction met in the passage, the greater the increase. If liquid be substituted for the air, the general result is the same, and the liquid may be made to boil upon its escape. If a somewhat plastic solid like hard pitch be subjected to the process, the energy required will be greatly increased, or the pressure required to force it through the tortuous passage of some length would be great. It may emerge hot and melted if the conditions be properly selected. If now we assume that any solid be subjected to a pressure such as to cause it to flow in a tortuous or restricted channel, it will, in so moving, rise in temperature and continue to rise until it has reached a degree of fluidity such as to lessen or practically to stop the absorption of energy in the moving mass, or until it escapes from the passage through which it is being impelled. The idea thus outlined may now be applied as an expansion of volcanic phenomena. For example, a hot water spring may be the result of the water having been forced by high pressure to traverse somewhat porous rock, or to pass through narrow but long fissures in which it is churned for a long time before escaping. In like manner, any rock mass which, subjected to very high pressure, begins to flow must become heated. If its distance of traverse be great enough in a restricted fissure or channel, it must melt or even become so heated as partially to vaporize when the pressure is relieved. Let it be admitted that the flexures taking place in the earth's crust, or in the outer portions of its crust, may bring to bear upon deep-seated, and perhaps already heated, solid rock masses a sufficient pressure to cause them to readjust their positions, and the condition demanded by this theory is present.—*Abstracted from Science (New York), August* 10.

Wood Preservation.

The increasing necessity for adopting some method of preserving wood is emphasized here by Bohumil Shimek. The rapid exhaustion of our forests is making this matter imperative, and although something may be done by proper cutting and seasoning, special treatment of the wood prolongs its life considerably. Whether special methods of preservation are employed or not, the wood should be well seasoned. To this end, if kiln-drying is impossible, the wood should be cut in the fall in order that it may have a longer time to dry slowly in the colder part of the year. If kiln-drying is practised, the wood may be cut at any season of the year. There is some advantage in using wood which has been rafted, or allowed to remain in water for some time, as this treatment dissolves out certain of the soluble organic materials. As a result, fungi find less available food material. The same result is secured by first steaming the wood. For railway ties, the steaming may be done in the open air without shelter. They should be piled in a place well drained and exposed to winds rather than the sun, and not more than two ties should come in contact with the ground. In piling, ample space should be left between the ties for ventilation. Hewn ties have smoother surfaces than sawn ties, and are, therefore, better. Charring and coating with paint or tar have some merit. The latter methods are effective only when they wholly exclude air. They are scarcely to be considered as methods of drying ties. The various preserving materials now used are given, and this is followed by a description of the methods and apparatus employed at the Alamogordo (New Mexico) Timber Preserving Plant. The plant is located in a territory in which practically only coniferous wood is available. The method employed is the Wellhouse zinc-tannin process, but the plant is also used for simple Burnettizing, in which only zinc chloride is used. The impregnating fluids are stored in large tanks from which they are drawn and to which they are returned by means of pumps. There are two retorts, each 106 feet long, having a capacity of 546 eight-foot six by eight-inch ties. The ties are placed on steel cars and run into the retort in which they are steamed under pressure of twenty pounds for four or five hours. A vacuum of twenty-two inches is then created, and a four per cent solution of zinc chloride is introduced under 100 pounds pressure for four hours. The amount of pure chloride consumed per cubic foot of wood varies for the material here employed from 0.29 to 0.33 pound. The chloride is then followed by tannin, of which a sixth of a pound per cubic foot is employed for about one and one-half hours, and this in turn is followed by a one-half per cent solution of glue. The entire run consumes from eleven to eleven and one-half hours. If green wood be used, the time required for steaming and impregnation must be extended from one to one and one-half hours each. The process darkens the ties somewhat. After the treatment, the ties should again be thoroughly seasoned for several months before they are used.—*Abstracted from the "Transit," State University of Iowa, Iowa City.*

Methods of Getting New Business.

A department devoted to the commercial development of Central Stations. Managers are invited to contribute suggestions for methods of increasing the demand for electric service.

THE WINNING OF POWER BUSINESS.

BY S. M. KENNEDY.

It would seem as if there were now no excuse for the existence of an electric company, if its object is to sell light only. It is probably true that there are scores of such companies operating all over the United States, but, after all, they are only existing. If they sell light only, they have no day load. If they have no day load, then they are not getting proper returns out of their investments—for day load is the "velvet" of the central station business. The "peak" of lighting load makes a profitable day load possible, because it means that there is so much installation ready for use at any time. And here it may be noted that it is a poor rule that does not work both ways. For the profitable day load makes it possible to sell the lighting current at lower rates. And low lighting rates mean long-hour load, increased consumption, and less liability of competition.

But I can imagine the remarks of some central station managers who are operating in smaller cities and towns: "It is all very well for you to talk about day load, but there is no power business here." Well, in answer I would ask: "How do you know? Have you investigated the possibilities?"

There is one important difference between selling light and selling power. A certain amount of lighting business will come without asking. But, it may be accepted as an axiom that power business does not come; it must be sought. It must be sought; not carelessly, but intelligently; not irregularly, but systematically; not spasmodically, but persistently.

But, still we can hear doubtful ones cry: "Where shall we seek?" Well, let us take a look over your city. Let us ride together through its streets and, maybe, we will see where they are using some kinds of power now, and would probably use yours, if you would let them know they could have it.

Here is a machine shop. What is the matter with trying a motor in place of that evil-smelling gas engine. No, not one motor, but a number of small ones, on lathes, saws, blowers, drills, hoists, welding machines, etc.; and why not electricity for the soldering irons and brazers?

There is a printing establishment. Those presses need motors more than anything else. Electricity is the only power for such work.

How about that planing mill? Just look at the reckless waste of power in that shafting and belting. Ever talk to the owner? Just once! Well, go at him again. He wants your energy worse than he knows—just because some one has not told him how much he would save in time and money.

That ice factory and cold storage plant were made for electric power, if anything ever was. You say you never thought of them! Well, give that concern some absent treatment, and then go after them with hammer and tongs. Why, with one or two motors in that place, the owner could leave his plant and forget it. It could run itself most of the day. But not so with the steam engine.

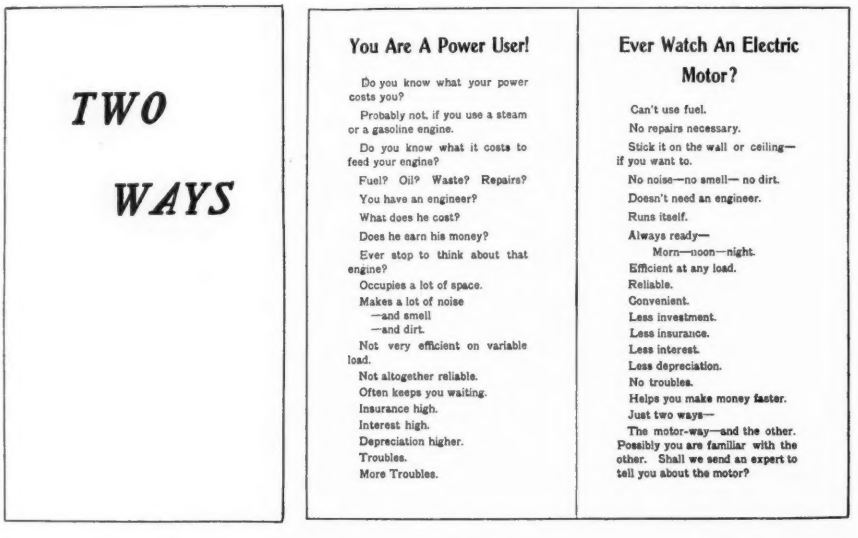
By the way, there is a church. No motor on the organ blower. No fan for making the air circulate. All your fault!

That's a dairy and creamery. There is such a thing as a motor which could operate that churn and cream separator. Another for the refrigerating machine and ice-cream freezer. Probably there is one which could milk the cows. Why don't you give that man a chance to make money?

But why recite a long list of instances. It really does not matter where you investigate in your city or town—in every nook and corner, in every store, factory, office, hotel and dwelling—there is a place for day power, and a real desire for it, only most people don't know they have the desire until you show them how it can be created and satisfied at the same time. Then they will tell you that they have always wanted just such a thing as the electric motor.

We have stated that power business must be sought, and it would appear as if this condition will always exist. But as your power business increases in importance and volume, the new business will not require to be coaxed as hard as in the early stages of its growth. Regarding the manner of seeking. The best of all is by means of trained solicitors, aided by judicious and careful advertising.

In ordinary electric light soliciting, an expert in the line is advantageous, but not absolutely necessary. In ordinary or extraordinary power soliciting, an expert is not only advantageous, but necessary. Much electric lighting business may be obtained by talking generalities, by pointing out the decorative features, and the adaptability to various conditions. But with power it is different, and the solicitor must get down to brass tacks. He must know of the comparative advantages of electrically driven power over steam and


TWO
WAYS
You Are A Power User!
Do you know what your power costs you?
Probably not, if you use a steam or a gasoline engine.
Do you know what it costs to feed your engine?
Fuel? Oil? Waste? Repairs?
You have an engineer?
What does he cost?
Does he earn his money?
Ever stop to think about that engine?
Occupies a lot of space.
Makes a lot of noise
—and smell
—and dirt.
Not very efficient on variable load.
Not altogether reliable.
Often keeps you waiting.
Insurance high.
Interest high.
Depreciation higher.
Troubles.
More Troubles.
Ever Watch An Electric Motor?
Can't use fuel.
No repairs necessary.
Stick it on the wall or ceiling—if you want to.
No noise—no smell— no dirt.
Doesn't need an engineer.
Runs itself.
Always ready—
Morn—noon—night.
Efficient at any load.
Reliable.
Convenient.
Less investment.
Less insurance.
Less interest.
Less depreciation.
No troubles.
Helps you make money faster.
Just two ways—
The motor-way—and the other.
Possibly you are familiar with the other. Shall we send an expert to tell you about the motor?

gasolene engines. He must be able to point out to the prospective consumer where a saving of investment, energy, time and money may be made by adopting the motor in place of the engine. As a rule the power user is a hard-headed business man. The solicitor drops in and tells him a fascinating story about the utility, flexibility and reliability of the electric motor. After he has finished his story the power user will ask: "Well, what will it cost?" That's the first question, and the solicitor must not hesitate or show any weakness in his answer. He must know what will be the cost, under given conditions, and how to explain it so that the advantages will be apparent. A successful power solicitor must be a man who knows both sides of his subject, who knows the advantages and disadvantages of steam and gasolene, and who knows the advantages, and what are erroneously called the weaknesses, of electric power service. It takes persistent soliciting to close power contracts. It is the only certain way to obtain this kind of business, and power solicitors must of necessity receive instruction and education of an exact nature, so that they may be able to talk intelligently and accurately about what they have to sell.

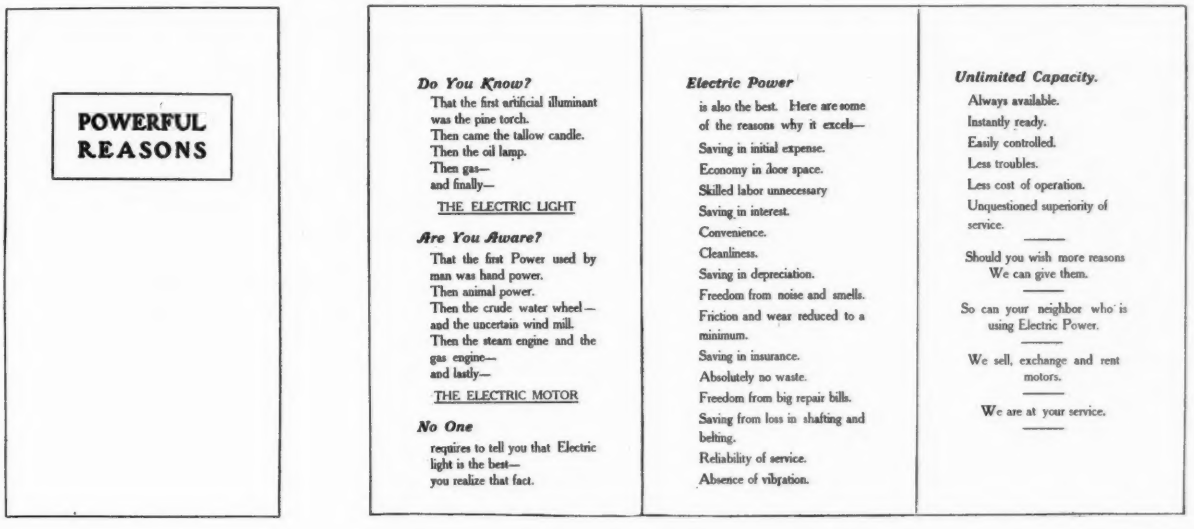
When the solicitor has a prospective power customer, the first thing for him to do is to find out what the man needs—then sell it to him. There is no use trying to sell the man more than he needs—but do not stop at less. It may be that to start the consumer will feel his way with a smaller amount than he really requires, but the solicitor must keep at him until he has all. The "all" will come if the "sample" is satisfactory, and the solicitor can see that things run so smoothly that there will be no complaint.

There is one class of power business which needs careful handling. I refer to power users who already have energy other than electric. It often happens that a power user may be interested in electricity, but has his money tied up in a steam or gasolene engine, and does not wish or thinks he can not afford to invest more. This condition might bar such a man from using electric energy for a long time, unless he is shown a way to dispose of his old plant. A solicitor who is well informed can usually find a place to put the old machine. There are dealers in second-hand engines, who at times may not offer very much for a plant, but who will give something, and this "something" is usually enough to lay the foundation for closing a bargain and signing a contract. Owing to the low cost of motors, most of such exchanges can be made without loss to the electric company, although in some cases it may be figured that an initial loss must be met in order to obtain permanent and profitable power business.

But let the solicitor remember that there is nothing to be gained in such transactions, by speaking in a disparaging manner of the old plant. It may be the prospective consumer has a real affection for his engine. He may have had it when he could not obtain your electric power, and it may have stood him good service in the past. Further, it represents an investment, and it does not put him in a pleasant state of mind to be told that his plant is not worth anything. Praise the motor, say all you can for it, but in most cases, where a man has an old engine, let him realize his disadvantage without rubbing it in too hard.

Another important matter in developing power load is to obtain the "entering wedge." Many power users—such as factories, planing mills, laundries and others—have their own plants, but a day comes when their business demands more power, and they do not wish to increase the boiler capacity, give up more space, or spend much money. This is the power solicitor's opportunity. If he has kept in touch with such concerns, they will send for him to talk it over. That should settle it for the motor, and all additional power for that concern thereafter.

The man going out after electric power business needs to be well loaded with suitable ammunition. It goes without saying that all the peculiar advantages of motor-driven power should be at the tip of his tongue, and he should be able to parallel them with the disadvantages of other power schemes. He should have a carefully prepared list of these pros and cons in his pocket-book, so that as he is talking to a man he may cast his eye over the list to see that he has omitted no points which might be useful in gaining his object. The point or advantage which will appeal to one man may not touch another; but there are always some items which interest, and these are the ones to dwell on the most. The central station manager should keep his power solicitors well supplied with folders and booklets, telling in a concise way the adaptability of electric energy for different kinds of power in general, and of some cases in particular. The solicitor can regularly leave one of these on a man's desk, or mail it to him. If sent before a call, it will open up the way; if sent after a call, it will help to drive home some of the things talked of during the interview. An up-to-date list should always be handy, showing the electric power consumers in your city. If a man


POWERFUL REASONS
Do You Know?
That the first artificial illuminant was the pine torch.
Then came the tallow candle.
Then the oil lamp.
Then gas—
and finally—
THE ELECTRIC LIGHT
Are You Aware?
That the first Power used by man was hand power.
Then animal power.
Then the crude water wheel—and the uncertain wind mill.
Then the steam engine and the gas engine—
and lastly—
THE ELECTRIC MOTOR
No One
requires to tell you that Electric light is the best—
you realize that fact.
Electric Power
is also the best. Here are some of the reasons why it excels—
Saving in initial expense.
Economy in floor space.
Skilled labor unnecessary
Saving in interest.
Convenience.
Cleanliness.
Saving in depreciation.
Freedom from noise and smells.
Friction and wear reduced to a minimum.
Saving in insurance.
Absolutely no waste.
Freedom from big repair bills.
Saving from loss in shafting and belting.
Reliability of service.
Absence of vibration.
Unlimited Capacity.
Always available.
Instantly ready.
Easily controlled.
Less troubles.
Less cost of operation.
Unquestioned superiority of service.
Should you wish more reasons We can give them.
So can your neighbor who is using Electric Power.
We sell, exchange and rent motors.
We are at your service.

is considering the use of electric energy, one of the most convincing arguments a solicitor can use is to refer him to others who are doing similar work by means of electricity. The prospective consumer can eliminate all doubt and guesswork, by seeing the people he is referred to. He can watch the operation, and learn the cost from a disinterested party who probably has used other power as well as electricity, and who can explain why he commenced using the motor, and why he would not change.

In the smaller cities the newspapers may be used with advantage in advertising electric power. Not so much in space advertising as in reading notices, announcing the fact when a well-known firm, company or corporation installs electric energy for operating their machinery. This makes good reading for all parties.

The central station manager, looking towards the upbuilding of the power end, must do everything possible to nurse the business as it comes on. There will be more or less difficulty at first with each new consumer, mostly arising from inexperience in handling motors. But whether a man is a new consumer or an old one, if he is in trouble with his power service in any way, he should have immediate attention. As a matter of fact, one power customer will give more trouble than twenty lighting customers. Why is this? Just because the power is used mostly in the daytime, by people who are making a living from their daily work. The power being off stops work, and means loss of time—maybe for many employés. But it often happens that a temporary interruption of light may occur without much annoyance. Light is usually required at night—but most of the world's labor stops by the time darkness comes on. The power business is exacting, and its big and little troubles demand prompt action.

In cities where an electric company has a number of solicitors, it has been found an excellent plan to arrange a series of competitive prizes for the obtaining of new power business. Say, for instance, there are six solicitors. The territory for each man's work can be so arranged that his district will include part of the business area and part of the residence section. This arrangement will likely give each man a fair chance. Then, on the results of a stated period, say three or six months, offer a first and second prize for the following:

1. New Power Customers Added;
2. Number of Motors Added;
3. Additional Horse-Power Added;
4. Percentage of Increase in Power Income.

A competition of this sort creates a spirit of healthy emulation among the men, and the cash prizes are incentives for increased work.

Power business is contagious. It will be found that the first score of customers and the first hundred horse-power will be the hardest to obtain. But after that the same amount of work will produce greater results, and by keeping constantly at it, a profitable day load will surely be obtained, and better returns on the company's investment will result therefrom.

NOVEL GAS ADVERTISING AT PUEBLO, COLORADO.

D. S. Greenwood, manager of the commercial department of the Pueblo-Colorado Gas and Fuel Company, describes an amusing method of advertising in the August issue of *Progressive Age*. Upon the occasion of the visit of a large circus to the town, the company advertised for as many dogs as they could secure. Some 600 boys turned up with dogs of every description, and at the tail-end of the circus parade these 600 dogs were either led or dragged, each bearing a blanket upon which was an inscription, "Cook with Gas." Mr. Greenwood states that the parade was immediately forgotten, and that "Cook with Gas" was impressed upon the entire population in Pueblo in fifteen minutes. Every one said that "it was grand" and that the gas company was the talk of the town. The morning papers were full of advertisements concerning lost dogs, and there was also considerable gratuitous matter concerning the enterprise of the company.

Municipal Ownership Abroad.

A despatch from Berlin, Germany, to the Chicago *Daily News* says:

"Mayor McClellan, of New York, who has been in Berlin for the last five days incognito, to-day expressed the opinion that much of Europe's vaunted municipal superiority is a delusion and a snare. In an interview to-day he said:

"'I have kept my eyes wide open for evidence of successful municipal operation, particularly in Germany, which is constantly held up as an example, but I have failed to find it. I have discovered conditions in cities like Frankfort and Dresden, which own their street railroads, which no American community of second-rate importance, to say nothing of New York or Chicago, would tolerate. Not only is the traffic of these places insignificant, judged by American standards, but it is handled inadequately and inefficiently.

"'The conditions in Great Britain, with the possible exception of Glasgow, where our cousin Mayor Dunne, of Chicago, has been taking lessons, are even worse than on the Continent. The British tramways act of 1873 gives municipalities options upon franchises before the franchises exist and the result has been perpetuation of old fogyism and the stunting of private enterprise. My European observations convince me more than ever that municipal operation is the last desperate means which ought to be resorted to only when private enterprise has absolutely failed.'

Belmont Tunnel Terminus.

The New York & Long Island Railroad Company, the builder of the so-called Belmont tunnel, has purchased the Kelley property at the corner of Fourth street and Jackson avenue, Long Island City, and it is understood that the terminus of the tunnel under the East river will be at that point. The price paid is said to have been $240,000. The company had to have the corner for its first outlet on the Long Island side. The tunnel will not come to the surface at that point, but the station there will probably have direct connection with the Long Island Railroad and the Pennsylvania terminus nearby. The property purchased comprises about four city lots.

New York & Ontario Power Company.

The New York state commission of gas and electricity has received the application of the New York & Ontario Power Company, to Waddington, St. Lawrence county, for a certificate of authority to transact business and to issue $2,000,000 bonds and $2,000,000 stock. The company proposes to purchase and develop a dam and water power across and adjacent to a branch of the St. Lawrence river, from the Isle au Rapids plant to the south side of the St. Lawrence river, in order to furnish light and power to Waddington and Ogdensburg.

The Tunnel of the Electrical Development Company, of Ontario, Completed.

The announcement is made that the tunnel of the Electrical Development Company, of Ontario, at Niagara Falls, has been completed. It has taken three years to build, and is credited as one of the greatest achievements in the history of the Niagara falls electrical development. The tunnel extends from the power-house several hundred feet above the Horseshoe falls to a point under the cataract. On October 1 a banquet will be given at the Clifton House, Niagara Falls, Ontario, to celebrate the completion of the works.

INDUSTRIAL SECTION.

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS.

G. I. Outlet Boxes.

The accompanying illustrations show the new G. I. adjustable water-tight floor outlet box and the P. R. floor outlet box, manufactured by the Stanley-G. I. Electric Manufacturing Company, Pittsfield, Mass.

FIG. 1.—WATER-TIGHT FLOOR OUTLET BOX (ADJUSTABLE).

Fig 1. shows the G. I. water-tight floor outlet box (adjustable) equipped with double outlet nozzle. Fig. 2 shows the receptacle and plug in outlet box.

The body of the box is drawn in one piece from one-eighth-inch cold-rolled steel of the best grade, and the adjustable collar is made of the same material in one

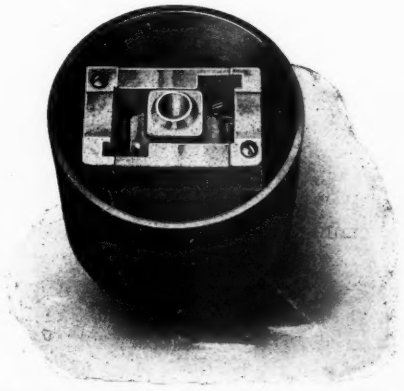


FIG. 2.—RECEPTACLE AND PLUG IN OUTLET BOX.

piece. The threaded portion is designed to give an adjustment of one inch so that the depth of the box may be increased from three and three-eighths inches to four and three-eighths inches.

The floor-plate is made of heavy brass and is fastened to the iron collar by screws, a rubber gasket being provided to ensure a water-tight joint.

The exposed surfaces of the plate and nozzle have a polished brass finish, and the steel body is heavily japanned inside and out. It is substantially built and will not sink in the floor when subjected to heavy weight.

By the use of a new type of outlet nozzle it is not necessary to remove the floor-plate when inserting or removing the plug. When not in use both nozzle and plug can be readily removed and the box closed by means of a brass flush sealing plug (see Fig. 3). Both nozzle and sealing plug are provided with rubber gaskets to ensure a water-tight joint. The conduit holes can also be closed, when necessary, by brass plugs.

FIG. 3.—OUTLET BOX WITH SEALING PLUG INSERTED.

Various forms of attachment plugs and receptacles may be used with this box. The hole in the outlet nozzle is of such a diameter that reenforced cord may be used when desired.

The boxes are furnished with either round or square floor-plates. The adjustable iron collars to which the plates are secured are also furnished with round or square flanges to fit the plates. If boxes are purchased separately from the plates care should be taken to specify whether the flanges on the adjustable collars should be round or square to fit the plates.

In installing, the box or lower part (the collar and plate being removed) should be set level from one to one and one-half inches below the upper surface of the floor. This should be done when the conduit is run. The box should be filled with excelsior or paper to prevent the entrance of plaster or rubbish before the floor is laid.

The adjustable collar with floor-plate attached can be set in place when the floor is laid or afterwards. The thread of the steel collar should be well leaded before screwing it into place so as to make the joint thoroughly water-tight. If set in

FIG. 4.—P. R. OUTLET BOX.

marble or tile floor, the rough edges around the brass floor-plate should be filled with cement. The socket or receptacle can be connected either before or after the floor-plate is set.

The dimensions of the box are as follows: diameter across floor-plate, five inches; diameter lower body, four inches; height, adjustable from three and three-eighths inches to four and three-eighths inches; weight, complete with nozzle, three and one-quarter pounds.

The P. R. outlet box, Fig. 4, is designed for use with either iron or flexible conduit.

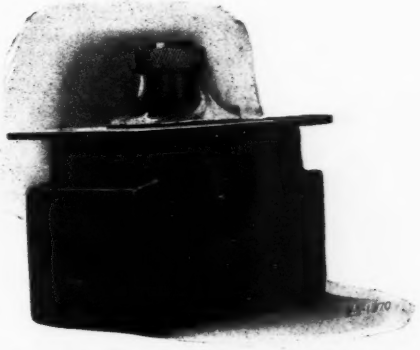


FIG. 5.—P. R. OUTLET BOX, WITH NOZZLE.

It encloses a porcelain receptacle and an attaching plug to which a flexible lamp cord is attached (Fig. 5). When the receptacle is not in use the hole in the floor-plate is closed by means of a flush sealing plug. Both nozzle and sealing plug are

provided with rubber gaskets to ensure a water-tight joint and are the same as the nozzle and sealing plug used with the G. I. outlet box.

The box is rugged in construction, the exposed portion being finished in polished brass, and the body finished in black japan. A feature of these boxes is the ease with which they may be installed.

The dimensions of the box are as follows: length of box, four and one-quarter inches; width of box, two and three-quarters inches; depth under face-plate, two and seven-eighths inches; floor-plate, four and three-quarters inches by three inches; weight, complete with plug and receptacle, three and three-eighths pounds.

Power-Operated Hatches.

Armor hatches have been a problem ever since the protective deck was introduced. Means must be provided for raising and lowering the hatch plate quickly and safely under all circumstances, and as the plate weighs sometimes as much as half a ton, the problem is by no means a simple one.

Block and tackle which has been used in the past is inconvenient and dangerous because the plate is likely to become unmanageable when the ship is rolling. Accidents from this cause have been frequent. The one thing essential to the safe handling of these heavy plates is that they be mechanically held at all times so that they can not drop or swing back. This result has been accomplished in the "long-arm" electrically operated hatch gear, of which a new model has recently been approved by the Bureau of Construction and Repair of the United States Navy Department.

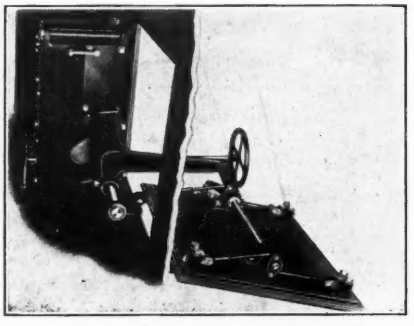
This gear is so designed that the hatch plate while being operated is always under control and held firmly, at whatever angle the plate may be to the deck.

The two essential parts of this apparatus are the hatch lift, a cast-steel box containing the motor, controller and gearing; and the lever system for connecting the hatch lift with the plate, for operation and for locking the plate watertight when closed.

The hatch lift is secured under the deck by the side of the opening. Projecting from the side of the hatch lift is a heavy crank which can be rotated either by the motor or by an auxiliary handwheel, above or below deck. From this crank power is derived to open, close and lock the hatch plate. The lever system consists of a substantial fulcrum shaft rotating in a bearing bolted to the underside of the protective deck, almost under the hinges of the plate. This fulcrum shaft carries a bent lever standing out beneath the hatch plate and connected to the locking mechanism on the hatch plate by a substantial link. The bent lever does not obstruct the clearway when the hatch is open.

The locking mechanism is an important feature, consisting of a number of bars all connected to one shaft across the centre of the plate and so arranged that when the shaft is rotated the bars are forced out beneath the deck and draw the hatch plate firmly down to its seat. The mechanism is actuated by the lift, and does not require separate manipulation. When the hatch is closed and locked and the operator starts to open either by hand or power, the lift first unlocks the plate, after which it opens to any desired extent. A mechanically operated stop prevents the locking gear from throwing out the bars except when the hatch plate is completely closed.

The motor and controller of the hatch



Long-Arm Hatch Gear.

lift are connected with a central emergency station located above deck, and form a part of the system by which the main bulkhead doors of United States warships are controlled from the central station. The hatch lift, in common with the "long-arm" system doors, possesses a "liberty action" which enables a man who may desire to pass through the hatch while it is being closed from the central station or after it is completely closed, to arrest and reverse the power action. This is accomplished easily and safely simply by turning the controller handle. When the lever is manipulated the closing operation is suspended and the hatch opens sufficiently to allow passage through the opening. As soon as the controller handle is released the hatch automatically closes again, as though no interruption of the emergency closing had taken place.

The great importance of this feature of the mechanism is that it eliminates danger and gives freedom to those who may be compelled to pass through the hatchway while it is being closed from the emergency station.

In common also with the "long-arm" doors, the hatch lift is provided with an automatic cutout so that in case an obstruction prevents the complete closure of the hatch plate, the current to the motor is cut off, preventing injury. After the obstruction is removed, the motor is automatically started, this follow-down action doing away with the possibility either that the apparatus will be injured or that, after an emergency closure is interrupted, the hatch will be left open by some one passing through it.

The "long-arm" hatch-gear thus offers three methods of operation—at the hatch, both above and below deck, by power which is brought into action by means of the controller handle; above and below deck by means of the hand gear intended for use in case the electric power should fail, and from the emergency station on the bridge by means of which the closing of all power-operated hatches on the ship is always instantly possible.

Forty Thousand Horse-Power in Hydraulic Turbines for Duluth.

The plans of the Great Northern Power Company, of Duluth, Minn., for the development of water power in the Northwest, when they are brought to full completion, will provide for the transmission of 200,000 horse-power. The power plant which is now under construction will have an initial equipment for the generation of 40,000 horse-power, with an ultimate capacity in this one station of 80,000 horse-power. It is located three miles from the city limits of Duluth, on the St. Louis river, the distance for transmission to the distributing centre being fourteen miles, to the cities of Duluth and Superior, where substation equipment will be provided. From the strategic position of the generating stations the future possibililties of the development may readily be surmised. The Mesabi and Vermillion iron ranges, in which the greatest iron mines of the world are located, lie from fifty to seventy-five miles to the northward of the plant and are destined eventually to be operated from it. Along the southern shore of the lake to the westward and within transmission distance are the Gogebic Crystal falls and Gogebic iron ranges and the copper mines of the Calumet district. The railway and lighting interests of Duluth and Superior have already contracted for electricity from the new source, and the long harbor frontage of docks and warehouses offers great opportunities for the use of electric hoists, lamps, etc. The transfer

of freight at the head of the lake between steamships and railroads reaches an enormous figure. For the year 1905 the tonnage entering Duluth, Superior and Twin Harbor amounted to 25,000,000 tons, or more than that from the port of New York.

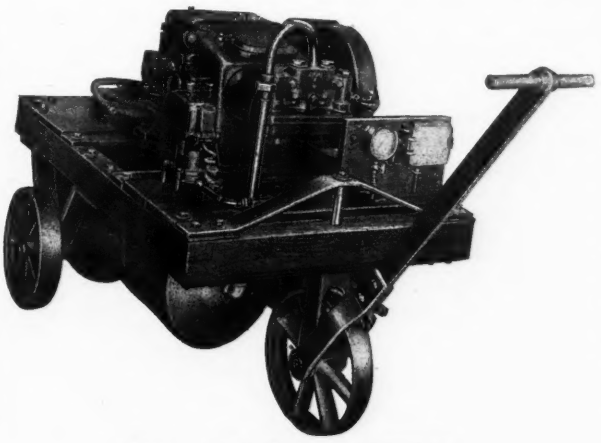
The distance from the head-gates to the power-house is 2.8 miles, about two miles of which is canal and forebay. Over the remaining distance the water is carried through about 3,800 feet of wood-stave pipe and about 1,000 feet of seven-foot steel pipe for each water-wheel unit. The difference in elevation between forebay and power-house is 378 feet. The building, which for the present will be 181.5 feet long and seventy-seven feet wide, will be constructed of brick masonry with framing. The initial hydraulic apparatus consists of three turbine water-wheel units, each designed for a capacity of 13,000 horse-power. They will operate at a speed of 375 revolutions per minute from a fall of 389 feet. The wheels are furnished by the Allis-Chalmers Company, Milwaukee, Wis., and are of the single vertical Francis type. The exciter outfit will comprise two single vertical impulse exciter wheels, each one developing 350 horse-power at 500 revolutions per minute from a 336-foot head. The general scheme of the Great Northern development was originated by T. A. Cokefair, of Duluth, and was executed by the National Contracting Company under Mr. Cokefair's direction as chief engineer.

Portable Air-Compressor Outfit.

An especially neat and compact portable air-compressor outfit has recently been placed on the market by the General Electric Company, Schenectady, N. Y. A convenient means of obtaining a supply of compressed air for various purposes about power-houses and car barns is in demand and the new outfit meets the requirements of such service. Compressed air is used in the power-house for cleaning generators, rotary converters and switchboards, and it has a wide application in car barns for cleaning dust from cars and trucks and removing copper and carbon particles from armature windings and controllers. In addition to the more apparent use of this compressed-air outfit, small tools such as drills and chisels can be operated by such a compressed-air supply. Being portable the entire set can be drawn to different parts of the power-house or shop or put on cars and transported to sub-stations; the electrical connection with the trolley circuit is quickly made through a contactor box on the truck and a convenient length of hose used to convey the compressed air to the work. This eliminates waste of air due to unnecessarily long hose or leaky pipe connections.

The portable air-compressor set manufactured by the General Electric Company consists of a standard CP 22 (twenty-four-foot) air compressor similar to that used in the company's air-brake systems, a governor, insulating connector, safety valve, gauge, combined switch and fuse, two reservoirs sixteen inches by forty-eight inches, hose, contactor box, and stop-cock, all mounted compactly on a three-wheel truck, as shown in the illustration. In the centre of the truck is placed the air compressor and motor with the governor at one side and the gauge and circuit-breaker mounted on a small board in front. The two steel reservoirs are carried beneath the truck floor, keeping the centre of gravity of the outfit very low. The framework and tongue are of wrought iron and the front wheel is hung in a pivoted fork of the same material.

The various parts of this outfit are of the same standard and durability as the regular General Electric Company air-brake equipments for cars. The compressor consists of a 500-volt motor of the railway type connected by a herring-bone gear drive to a double-cylinder air compressor. The complete unit is entirely enclosed with provision for thorough lubrication. The gearing runs in oil, making it as noiseless as possible. The governor is entirely automatic and thoroughly protected, and adjustments are provided so that the pressure at which it will act can be varied to open at any point between 60 and 100 pounds per square inch of pressure in the steel reservoir. In addition to the governor an adjustable pop safety valve is provided which prevents the possibility of an excessive pressure on the reservoirs. In the combined switch and fuse, mounted vertically with the gauge, all current-carrying parts are enclosed in moulded insulation, and a powerful magnetic blowout is provided for extinguishing the arc. With each machine twenty-five feet of special armored air hose is furnished complete with stop-cock, coupling and nozzle for connection to machines or for cleaning purposes.



PORTABLE AIR-COMPRESSOR OUTFIT.

The general dimensions of the General Electric Company's portable air compressor are as follows: height, three feet seven inches; width, three feet eleven inches; length, five feet eight inches.

Power Machinery Exportations.

The Westinghouse Machine Company, East Pittsburg, Pa., has recently sold to the United States government for use in connection with the Panama Railroad two compound steam engines; one direct-connected to a 325-kilowatt, 250-volt engine-type generator, and the other to a 200-kilowatt, sixty-cycle, alternating-current, two-phase, 220-volt generator. Both operate under a steam pressure of 150 pounds.

Two 165-brake-horsepower producer gas engines are to be installed in the plant of the Calgary Milling Company, at Calgary, Alberta, Canada. The engines operate at an altitude of 3,000 feet, using anthracite coal for fuel, with a possibility of a change to natural gas as soon as supply is obtained.

G. & O. Braniff & Company have ordered a 300-kilowatt Westinghouse-Parsons steam turbo-generator unit. The turbine will operate on 150 pounds of steam pressure and twenty-seven inches vacuum, and will be installed in the plant of S. Roberts & Company, Mexico City, Mexico, generating fifty-cycle current at 6,000 alternations.

The Rio Janeiro Tramway, Light and Power Company will install at Rio Janeiro, Brazil, a 300-kilowatt Westinghouse compound engine unit operating under a steam pressure of 150 pounds and direct-connected to an alternating-current generator.

CURRENT ELECTRICAL NEWS

DOMESTIC AND EXPORT.

TROLLEY FOR MISSOURI TOWNS—The promoters of the interurban electric railway between Jefferson City and Sedalia have decided to incorporate a company at once to build the line, and a committee consisting of C. W. Thomas, of Jefferson City; Nelson Leonard, of Bunceton, and J. H. Decker, of Sedalia, has been appointed to look after the details of incorporation. It is estimated that the line, eighty-three miles in length, can be built and equipped for about $1,500,000. It will open up some rich agricultural sections

HALF A MILLION FOR IMPROVEMENTS—The Terre Haute Traction and Light Company has decided on improvements to the extent of half a million dollars, and it has been announced that work is to begin at once. The improvements will include the enlarging of the Water street power station to twice its present size, the building of a substation at Brazil, the straightening and leveling of the Brazil Interurban line and a general improvement of the local station. Plans for the work on the Water street station have almost been completed while the plans for the other work are under way.

BELL TELEPHONE COMPANY OF CANADA—The directors of the Bell Telephone Company, of Canada, have decided to increase the capital stock of the company from $9,000,000 to $10,000,000. Stockholders of record August 31 will be entitled to one share of the new stock for every nine shares held at $125 per share. The right to subscribe will expire at 1 P. M. on September 15. Payment for the new stock may be made in full on October 1, or in four payments as follows: $50 on October 1, 1906, being $25 on account of stock and $25 on account of premium; $25 on November 1, 1906, $25 on December 1, 1906, and $25 on January 2, 1907.

MORE HUNTINGTON POWER PLANTS—H. E. Huntington and his Fresno and Los Angeles associates have decided to increase their electric power generating system in the mountains east of Fresno. Altogether they are to have four electric power plants on the San Joaquin and two on the Tulare river, which will give a total of between 35,000 and 40,000 horse-power. Part of the system is already finished and the remaining part will require a year and a half of work and an expenditure of over $1,000,000. The two Tulare river plants will have respectively 4,000 and 6,000 horse-power. Eventually much of this electric power will be used to operate an electric suburban and interurban railroad system of 200 miles which Huntington and his associates have planned with Fresno as the hub.

MAHONING & SHENANGO MERGER—The Youngstown Park & Falls Railway Company has been formally merged with the Mahoning & Shenango Railway and Light Company, completing the great system of the two valleys, which controls 125 miles of trolley lines as well as lighting franchises in Youngstown, New Castle, Sharon, South Sharon and Sharpsville. The status of the two companies is as follows: Youngstown-Sharon Railway and Light Company bonds, $3,500,000; preferred stock, $3,000,000; common stock, $5,000,000; floating debt, $750,000; total bonds, $6,375,000; preferred stock, $3,000,000; common stock, $7,500,000; floating debt, $1,050,000. The condition of each company as it existed July 1, 1905, is to be the basis of its merger, as of which date both companies will be free from floating debt. The bonded indebtedness of the Youngstown & Sharon Railway and Light Company shall be reduced to $2,800,000.

NEW YORK-CHICAGO AIR LINE—Joseph Ramsey, Jr., Pittsburg, Pa., formerly president of the Wabash, announces that he will build a new trunk line railroad from New York to Pittsburg and thence to Chicago, the project to be financed by foreign bankers, and the road to cost $150,000,000. Surveys for the road have been completed and show that it will be eighty-five miles shorter than the Pennsylvania between Pittsburg and New York and 108 miles shorter than the present shortest line between New York and Chicago. It is proposed to operate the line with electric locomotives, and as the surveys give the new line a maximum grade of twenty feet to the mile, in comparison to the maximum grade of sixty-five feet to the mile on the Pennsylvania system, the new line will be able to develop high speed. The air line will run through both the bituminous and anthracite coal regions and numerous branch lines are planned as feeders. It will not touch Philadelphia, going through the northern part of Pennsylvania. After leaving Pittsburg the road will touch at the following towns in Pennsylvania: Freeport, Leechburg, South Bend, Shelocta, Cherrytree, Irvona, Dix, Loveville, Pine Grove Mills, Shingleton, Tusseyville, Coburn, New Berlin, Northumberland, Sunbury, Ashland, Mahanoy City, Tamaqua, Allentown and Easton. Preliminary work will be begun this fall on the line to New York, and actual grading will begin in the spring. The line west will be started as soon as the Pittsburg-New York line is completed. The surveys west are not final, and the promoters expect to lower the grade further and to shorten the distance before the road is laid out. The road to New York has been surveyed three times. Rights in the state will be got by merging the Indiana, Clearfield & Easton, the Allentown, Tamaqua & Ashland, and the Brush Creek & Crows Run Railroads. The foreign syndicate will build the road and turn it over completed to the New York, Pittsburg & Chicago Air Line, which will be capitalized at first at $1,000,000. The route west of Pennsylvania is to be kept secret, but it is stated positively that the Lorain, Ashtabula & Southern Railroad, which is now nearing completion, will be one of the many feeders in the West. Joseph Ramsey, who was in New York last week, has made the following statement relative to the new project: "We expect to make a start this fall and begin work next spring, hoping to complete the line between Pittsburg and New York within three years. The cost of the line between Pittsburg and New York is estimated at between $75,000,000 and $100,000,000, all of which has been pledged, the bulk of it by foreign capitalists. It would not be wise for me to give details or names now. The line is not merely a preliminary survey, but a final location that has been revised three times. Three corps of engineers have been busy for three years. It is the best possible short low-grade line to be had through Pennsylvania between Pittsburg and New York. The extension of the road west to Chicago from Pittsburg will be taken up when the line east to New York is completed."

NEW PUBLICATION.

THE ENGINEERS' CLUB OF PHILADELPHIA—The July number of the proceedings of the Engineers' Club of Philadelphia contains an article by Edwin A. Moore entitled "By-Product Coke Ovens," an article by Harrison W. Latta entitled "New Sea Wall at Annapolis," and an article by D. Robert Yarnall entitled "Garbage Disposal by Reduction." In addition to this material there are abstracts of the minutes of the club and the minutes of the board of directors, the additions to the general library, and two very interesting memoirs to Herman Haupt and Max Livingston.

NEW MANUFACTURING COMPANY.

PITTSBURG, PA.—A new $10,000 stock company known as the Pittsburg Electric Sign Company, with headquarters at 220 Collins avenue, secured a charter at Wilmington, Del., which also covers electrical manufacturing and the company will erect electric signs, heating appliances and irons. The new company willl make a specialty of arranging special lighting effects for socials, weddings, banquets, lawn fetes and church affairs. The officers and incorporators are: F. M. Kattenstroth, president; C. H. Brown, treasurer; Robert F. Miller, secretary, and E. E. Parsons, general manager.

LEGAL NOTE.

SUSPENDED SWITCH CASE—In the case of the Thomson-Houston Company, complainant, *versus* Sunday Creek Company, defendant, an opinion was filed on August 1, 1906, in the United States Circuit Court, District of New Jersey, by Joseph Cross, district judge, granting a preliminary injunction. The patent involved is the Van Depoele patent No. 424,695.

TELEPHONE AND TELEGRAPH.

PLAINVILLE, KAN.—The Plainville telephone system, established in 1901 by C. N. Gordman, is being entirely rebuilt.

WARREN, N. H.—The Bakers River Telephone Company at a recent meeting voted to increase its capital stock to $8,000.

ALLENSVILLE, KY.—The Todd County Home Telephone Company has been organized with $35,000 capital. Exchanges will be built at once in Elkton, Trenton and Allensville, Ky. Ben Petrie is president of the company, and it will be represented at Allensville by B. C. Carvell.

ROMEO, MICH.—The Home Telephone Company, of Romeo, organized in 1901 by ex-Postmaster James B. Lucas, has been purchased by the Michigan Telephone Company. The plant has not been in operation since 1904, owing to lack of patronage and the inability of the owners to get Detroit connections.

PHILADELPHIA, PA.—The Keystone Telephone Company is increasing the capacity of its main central station to its full capacity of 7,200 lines. This has been made necessary by the addition of subscribers and increased business from long-distance lines recently absorbed by the company.

RAVENA, N. Y.—The representatives of the Home Telephone Company have been securing contracts and about fifty telephones have been installed and a thoroughly up-to-date central office has been established. The company asserts that it will give an efficient service at all hours of the day and night.

FOXCROFT, ME.—Poles for an independent farmers' telephone line between Foxcroft and the neighborhood of McNaughton's in Sebec have been set and wires will soon be strung. There are fourteen subscribers there. There are now 100 lines verging from the central office; the number of patrons is 384.

SPOKANE, WASH.—Not satisfied with the prices charged by the through lines, the Farmers' Mutual Telephone Company has been organized at Granger, Wash., with a capital of $50,000, and it is announced that connections will be made with the Spokane Home Telephone Company's lines. Work is to begin in two weeks.

SPOKANE, WASH.—Negotiations are making by the completion of which the Pacific States Telephone Company will gain control of all the territory in the Palouse country, south of Spokane. The company has made offers in various towns in the district to cut the present rate of $18 a year to $1 and put in the instruments at actual cost.

SPOKANE, WASH.—Farmers at Rock Island, west of Spokane, are organizing a mutual company to run a telephone line from that city to Wenatchee and to Badger Mountain, connecting also with Waterville, giving it connection with every town in the Wenatchee valley. It is purposed to extend the line into the Big Bend country before the end of the year.

SPOKANE, WASH.—The Kerr-Gifford Grain Company is installing a line from Walla Walla to Spofford, south of Spokane, and it is announced that four other farmer lines are building into the first-named city to make connections with the Pacific States system, which has also just taken over the rural lines at Milton, Wash., where a night service is to be added.

SPOKANE, WASH.—H. W. Kent, of Vancouver, secretary of the British Columbia Telephone Company, Limited, has announced that the central offices at Greenwood and Grand Forks will be rebuilt at a cost of $25,000, also that the company will extend a line direct from the boundary to Rossland, thus eliminating the detour into the state of Washington *via* Bossburg and Northport, as at present.

MARYSVILLE, CAL.—The telephone franchise asked for by F. W. Anderson, of Wheatland, for his farmers' line has been bid in by Attorney E. B. Stanwood, it being the general supposition that he acted for the Sunset company. Attorney E. T. Manwell, representing the independent concern, gave notice that he will at the next meeting of the supervisors again apply for a franchise.

SUTTON, MASS.—The selectmen have granted a franchise to the New England Telephone and Telegraph Company to erect poles and string wires for private telephones to a number of residences. It is expected that the telephone company will put in a telephone for the use of the town, and the location, instead of being at the town hall, will either be at the home of the chairman of the selectmen, Tyler Stockwell, or at the office of the town clerk, Henry C. Batcheller. This telephone will be put in without any expense to the town.

SPOKANE, WASH.—Three million dollars is the extent of the trust deed filed in Spokane county by the Home Telephone and Telegraph Company, of Spokane, in favor of the Title Insurance and Trust Company, of Los Angeles, Cal., the document being signed by Charles E. Sumner, president. It covers in blanket all the real and personal property, franchises, lines and extensions owned by the company. The company has bought a site for $25,000 in the business district, and it is announced a $60,000 office building will be erected the coming fall. The company will operate the automatic system, for which it has already signed 5,000 contracts in Spokane.

HOUSTON, TEX.—Papers of incorporation have been filed in Austin and a charter asked for the Southern Telegraph and Telephone Company, with a capital stock of $100,000. The headquarters of the new company will be Houston, the directors being George W. Burkitt, Louis J. Barnes, J. M. Reagan, Edward Kennedy and A. S. Fisher. It is stated that everything was in shape to begin the construction of the line at an early date. It will be a long-distance throughout the southern portion of the state, with local exchanges in the towns through which it will run, such as Richmond, Rosenberg, Wharton, Victoria, Yoakum and other places. It will run through the following counties: Harris, Galveston, Fort Bend, Wharton, Matagorda, Colorado, Austin, Brazoria, Waller, De Witt, Lavaca, Bee, Victoria, Jackson, Goliad, Gonzales, Nueces, Wilson and Bexar. The line will connect in San Antonio with the Citizens' company lines.

MEADVILLE, PA.—The Central District and Printing Telegraph Company has concluded a contract with the Crawford Telephone Company, a regularly incorporated concern, by which the latter becomes a sublicensee under the Central District and Printing Telegraph Company. There has been quite a contest for this business between the independent telephone people, operating the Eastern Crawford Telephone Company, and the Bell interests, for the contract with the Crawford Telephone Company. The Crawford Telephone Company is composed of a number of persons in Guys Mills, Townville and vicinity, who formed a company some time ago and who already have ten miles of line built. They propose to extend this line to make about fifty miles in all. At present it will serve Guys Mills, Lyona and Towneville and intermediate territory, and from the present indications have about seventy-five subscribers. The extension of the line when made will include Black Ash, Sugar Lake, New Richmond, Little Cooley and other points. The officers of the Crawford Telephone Company are: F. C. Bannister, of Guys Mills, president; W. C. Parker, of Randolph, secretary; Willis Waid, of Guys Mills, treasurer, E. C. Utley, of Randolph, general manager.

SOUTH BEND, IND.—By the recent action of the holders of four-fifths of the capital stock of $200,000 of the South Bend Home Telephone Company's independent plant, this property will soon pass to the possession of Joseph Harris, vice-president of the Automatic Electric Company, of Chicago, at $25 a share. This stock was bonus given with bonds to the original builders, and the consideration is therefore "velvet," as the builders hold the bonds to the value of $350,000 sixes, which sell above par. The buyers agree to assume the floating debt of $60,000 and invest $100,000 in the plant within twenty months in order to sustain security for the bonds. They gave a bond of $75,000 to perform the contract. The exchange includes substations at South Bend, Mishawaka, New Carlisle, Granger, River Park and Lapaz, including 800 farmer telephones and 200 miles of wire. The first result of the sale, it is declared, will be a toll line connection with Chicago, giving that city its first independent toll line service. South Bend will be made a distributing point for the independent toll lines in Indiana, Michigan and eastern points. The deal was effected through President Theodore Thorward, who will be retained as manager. The plant was built four years ago, and besides earning money for extensions it has paid interest on bonds and one per cent semi-annually on stock, but the local telephone investors, who built it over the opposition of South Bend's millionaires, faced the necessity of investing another $100,000 to meet the demands for new instruments and shaved their profit to escape further liability. The sale of the property involves the expenditure by the new owners of $500,000.

ELECTRIC RAILWAYS.

SEATTLE, WASH.—An electric railroad is to be built from Ketchikaw, Alaska, to Unuk River next year by the Unuk River Mining and Smelting Company. J. W. Daly is manager of the company.

AUGUSTA, GA.—The city council has given to the Anthony Shoals Power Company the right to use the streets of the city for its lines for a period of thirty years. The company is to pay the city one per cent on the gross earnings.

SUMMIT, N. J.—The city council has granted to the Morris County Traction Company a thirty-year franchise for a trolley road through the city. Under the present laws the question must be placed before the people at a special election and the ordinance ratified before it can become effective. Such an election can not now be held before December.

PITTSBURG, PA.—Edwin K. Morse, Harrison M. Williamson, Coleman E. Andel, Horace F. Baker and Martin Marshall have made application for charters for two corporations to be known as the Rebecca Street Railway Company and the Lawrenceville Street Railway Company, which are to be formed in connection with the Pittsburg Subway Company.

CARBONDALE, ILL.—Citizens of Carbondale are being urged to subscribe $1,500 as part of a $4,000 fund to be raised by Carbondale, Carterville, Murphysboro, Herrin and Johnson City, to be expended in making a preliminary survey for an electric road to run through all these towns. The sum of $4,000 is to be expended in a preliminary survey and to learn what the probable revenue for such a line would be. It is understood, of course, that the contributors shall have shares in the railroad in case it is built.

SPRINGFIELD, MASS.—Two petitions have been filed with the state railroad commissioners at Boston by the Springfield & Eastern Railway Company. If granted they will mean the connection of the road with the Worcester & Southbridge Street Railway Company, completing the link between Worcester and Springfield, and shorten the running time between the two cities. One petition asks the approval of the location granted by the Brimfield selectmen and the other asks the approval of the location granted in Monson.

RICHMOND, IND.—Charles L. Henry, receiver for the Indianapolis & Cincinnati Traction Company, has been authorized by the court to proceed with the construction and equipment of the Rushville-Connersville and the Shelbyville-Greensburg extensions. For this purpose an order was made for the issue of receiver's certificates to the amount of $900,000. These certificates will bear interest at the rate of six per cent, and will fall due August 1, 1907. It has been decided to build the extension of the Muncie & Portland Traction line from Portland to Celine, Ohio, and work is expected to begin soon.

NEWTOWN, PA.—The Newtown Electric Street Railway, a trolley line of fourteen miles, operated between Doylestown and Newtown by the Newtown Electric Street Railway Company, with certain rights on the Newtown, Langhorne & Bristol trolley lines, was sold at public sale to-day by Sheriff Albert S. Paxon on an execution for $650 issued by James and Mary Murphy, of Morrisville, who some time ago obtained a judgment in the Court of Common Pleas for damages sustained by the latter in being thrown down in a car at Hulmesville about three years ago. H. E. Woodman, president of the Union Railway Supplies Company, was the purchaser at $1,010.

JENNINGS, MO.—An application for a franchise to construct a double-track electric railway from the city limits of St. Louis and the Hall's Ferry road to Jennings has been made by the North St. Louis & Suburban Railway Company, of which James Scullin is the head. The company was recently granted permission by the city to build from the Broadway line to the city limits. It was stated that the present intention is to build only to Jennings, but later to extend the line to Ferguson and Florisant. The Florisant Valley Street Railway Company recently secured a franchise from the county court to construct a road from the city limits over practically the same route. It was granted, however, on condition that the company secure a franchise in St. Louis to connect with some line of street cars down-town.

ELECTRIC LIGHTING.

LEADVILLE, COL.—A franchise has been granted to Walter W. Davis to construct and operate an electric power plant and system.

GLENS FALLS, N. Y.—The franchise of the Hudson River Electric Company to operate in the village of Glens Falls has been extended for a year.

UTICA, N. Y.—The statement of the Hudson River Electric Power Company for June, 1906, shows gross earnings of $69,147.35, an increase over the same month of the previous year of 27.94 per cent. The operating expenses were $40,186.43, and the net earnings were $28,960.92.

SPRINGFIELD, MO.—Dr. B. E. Joseph has a charter granted under the laws of Arkansas to establish a power plant on the White river in Boone county, Ark. It is thought that several Springfield people will be interested in the scheme, which purposes the development of possibly 10,000 horse-power for distribution in both states.

MADISONVILLE, KY.—At a recent meeting of the city council, ordinances were passed requiring the Bailey Light and Water Company to remove all poles, wires, etc., from the streets and alleys of the city on or before September 2. An ordinance was also passed revoking any agreement with the company for the lighting of the streets of the city.

CHESTER, PA.—Capitalists, represented by John L. Garrett, a local attorney, desire to erect a $100,000 electric light plant in this city, and in a proposition to the light committee of councils they offer to turn the plant over to the city at the expiration of ten years. The Beacon Light Company, a private corporation, now has the contract for lighting the city.

HENRICO, VA.—By a unanimous vote the Henrico county board of commissioners have formally refused the application of the Passenger and Power Company for the rights of way in Highland Park and Chestnut Hill and other privileges necessary to the installation of an electric lighting system. The commissioners decided that the concessions asked by the company were unreasonable and excessive.

DURANGO, COL.—Durango taxpayers have voted to grant an electric light franchise to Tom Loftus and partners. The vote was 240 for and ten against. The new company proposes to erect a $25,000 plant. They have located a reservoir site four miles from town, from which they will obtain water power. The reservoir will be filled from Junction and Hermosa creeks. The new company promises to furnish light much cheaper than the old company.

STILL RIVER, MASS.—Indications now point strongly that the Boston Light, Heat and Power Company is planning to put its consolidated power plant on land now owned by Herbert W. Atherton, between the Boston & Maine Railroad and the Nashua river, on the west side of the railroad. Some time ago the company bought the land owned by the Union Paving Company, Worcester, but as this contained but half an acre, they needed more, and have been trying to get Mr. Atherton to sell the land adjoining.

COLUMBUS, OHIO—The Little Miami Light, Heat and Power Company, which was incorporated at Columbus recently, with a capital of $10,000, will utilize the water power of the Little Miami river by constructing a series of dams between the junction of the Little Miami and Morrow and placing a power-house at each dam. It is proposed to supply the following towns with current: Morrow, Lebanon, South Lebanon, Kings Mills, Hopkinsville, Foster's Crossing, Miamiville, Mason, Epworth Heights, Branch Hill, Camp Denison, Milford, Terrace Park, Plainville, Batavia and numerous other smaller towns which lie close along the shores of the Miami.

CANON CITY, COL.—The Colorado Light and Power Company has acquired a controlling interest in the La Bella Mill, Water and Power Company of Goldfield, which for several years has been one of the largest distributors of electric power in the Cripple Creek district supplying much of the motive force used in mining operations and for lighting purposes in Cripple Creek, Victor and surrounding towns. The absorption of the La Bella plant by the Colorado Light and Power Company will give that company a dominating influence in the electrical business of the district and will necessitate an enlargement of the Canon City plant to double its present capacity, rendering it one of the largest concerns of its character in the state. The local plant has a capacity of 2,000 horse-power, but this will be doubled in order to meet the needs of its wider field of operations.

PERSONAL MENTION.

MR. ELMER E. DAICY, of Auburn, Me., has been elected treasurer of the Maine Independent Telephone Association. Mr. Daicy is manager of the Lewiston & Auburn Telephone Company.

MR. FREDERICH SONNENSCHEIN, who has had charge of the West Point exchange of the Nebraska Telephone Company since its inception, has been succeeded by Mr. William Busch, of Omaha.

MR. WILLIAM MARCONI, it is announced, has joined the experimental staff of the Columbia Phonograph Company. His inventions in the talking machine art will be the property of the company.

MR. A. P. MULVEY, formerly with the Davis Electric Manufacturing Company, Springfield, Mass., is now associated with the H. Krantz Manufacturing Company, Brooklyn, N. Y., manufacturer of switchboards, switches, panel-boards and outlet boxes.

MR. RALPH W. POPE, secretary of the American Institute of Electrical Engineers, arrived at Montreal, August 11, on the turbine steamer Victoria of the Allan line. He has resumed his duties at 95 Liberty street, New York, after an absence of two months in England and Scotland.

MR. WILLIAM J. BARKER, who for the past twenty-five years has been in the operating department of the Denver Gas and Electric Company, Denver, Col., will retire on September 1 to assume the post of executive operating manager of the Northern Colorado Power Company. Mr. Barker will superintend the construction of the Northern Colorado Power Company's plant at Boulder.

MR. NICHOLAS F. BRADY, vice-president of the New York Edison Company, was married by Bishop Tierney in St. Joseph's Cathedral, Hartford, Ct., on the morning of August 11, to Miss Genevieve F. Garvan, daughter of former State Senator Patrick Garvan, and a sister of Assistant District-Attorney Garvan, of New York city. Many New York and Albany guests were present. Mr. and Mrs. Brady will tour Europe in an automobile, returning to New York in December.

OBITUARY NOTICE.

MR. E. B. C. HAMBLEY, vice-president and general manager of the Whitney Company, which is planning the extensive development on the Yadkin river in North Carolina, died on August 14 at Salisbury, N. C.

NEW INCORPORATIONS.

PIERRE, S. D.—South Dakota Union Telephone Company, Northville. $50,000.

MILLBURY, MASS.—Millbury Electric Company. $53,080.75. President, C. W. Mood; treasurer, Herbert A. Ryan.

JULIAN, NEB.—Farmers and Merchants' Mutual. $5,000. George F. Conlon, James Lockwood, C. L. Misnet, E. C. Ferguson and H. A. Hauptman.

OTTERBEIN, IND.—Lafayette & Hoopestown Interurban Railway. $10,000. Incorporators: Isaac E. Switzen, W. Walsh and Elmer Hawkins.

BOSTON, MASS.—Boston & Eastern Electric Railroad Company. Twenty miles, with a main line from Beverley to Sullivan Square, and a branch to Peabody and Danvers. $250,000.

DALLAS, TEX.—The Dallas Light and Equipment Company. $100,000. Incorporators: T. L. Camp, J. B. Nabors, C. E. Bird, J. A. Barnhard, of Dallas, and A. P. McArthur, of New York city.

DE KALB, ILL.—De Kalb Fuel, Light and Power Company. To construct, equip, operate and promote street and interurban railways. $100,000. J. Ross McCulloch, Olaf N. Guildlin and Charles H. Printz.

HARRISBURG, PA.—Brady's Bend & Butler Street Railway Company. To build a line from Brady's Bend through Kayler and Chicora to Butler. Incorporators: W. J. Horgan, E. W. Dewey, William Criswell, John Dady and W. G. Stern.

DES MOINES, IOWA—Boone, Webster City & Fort Dodge Interurban Railway Company. Incorporators: John C. Regan, of Des Moines; E. E. Hughes, John S. Crooks, J. H. Herman, M. J. Railly, T. L. Jones and John L. Gaephinger, of Boone; Frank A. Sackett, of Webster City. Officers: president, E. E. Hughes; vice-president, John C. Regan; secretary, John S. Crooks; treasurer, J. H. Herman.

ELECTRICAL SECURITIES.

The stock market early in the week entered upon a session of fluctuations, the like of which has not been witnessed for some time. The sensational announcement of the advances in the dividends on the Union Pacific and Southern Pacific stocks created almost panicky conditions. Along with the selling movement which this announcement caused, a great many other stocks took part in a sharp rally. However, at the end of the week a number of the leading stocks had fallen off, declining to practically the same level as existed a week previous. Concerning the general state of trade, the iron and steel industries show no evidence of abatement in activity. Railroad earnings are showing weekly increases of 13 or 14 per cent for gross, and it is stated that the net gains for the first half of the year amount to between 23 and 28 per cent. The announcements concerning the Ramsey air line between New York and Chicago were received in the financial community with more or less skepticism. It is thought that the $150,000,000 which it is announced is available would not more than buy the terminal facilities, if that amount really could accomplish so much. The engineering and rolling stock would necessitate an investment which would multiply many times that amount of money.

ELECTRICAL SECURITIES FOR THE WEEK ENDING AUGUST 18.

New York:	*Closing.*
Allis-Chalmers common	18
Allis-Chalmers preferred	48½
Brooklyn Rapid Transit	78
Consolidated Gas	139⅞
General Electric	170⅜
Interborough-Metropolitan common	37½
Interborough-Metropolitan preferred	78½
Kings County Electric	155
Mackay Companies (Postal Telegraph and Cables) common	73⅞
Mackay Companies (Postal Telegraph and Cables) preferred	72⅞
Manhattan Elevated	149¾
Metropolitan Street Railway	106
New York & New Jersey Telephone	127½
Western Union	92¼
Westinghouse Manufacturing Company	155

The Consolidated Gas Company has declared a regular quarterly dividend of 1 per cent, payable September 15.

The Brooklyn Heights and the Nassau Electric, the two principal operating companies of the Brooklyn Rapid Transit Company, have filed at Albany their income accounts for all the four quarters of the fiscal year to June 30. The former shows a gain for the year of $1,397,594 in gross earnings. Together they show a gain of $1,880,434 in gross and $1,233,380 in net.

Boston:	*Closing.*
American Telephone and Telegraph	133½
Edison Electric Illuminating	237
Massachusetts Electric	70
New England Telephone	131½
Western Telephone and Telegraph preferred	85

The instrument statement of the American Telephone and Telegraph Company for July is as follows: gross output, 227,755; returned, 70,757; net output, 156,998. For the seven months of the current fiscal year the net output has been 960,520. The total number now outstanding is 6,658,778.

Philadelphia:	*Closing.*
Electric Company of America	11
Electric Storage Battery common	74
Electric Storage Battery preferred	74
Philadelphia Electric	8⅜
Philadelphia Rapid Transit	30¼
United Gas Improvement	88
Chicago:	*Closing.*
Chicago Telephone	119
Chicago Edison Light	137
Metropolitan Elevated preferred	67
National Carbon common	86½
National Carbon preferred	119½
Union Traction common	4
Union Traction preferred	14

INDUSTRIAL ITEMS.

MR. H. DENNER, Apartado 63, Mexico City, Mexico, is looking for manufacturers who desire representation in Mexico.

THE C. W. HUNT COMPANY, West New Brighton, Staten Island, N. Y., has published a new bulletin descriptive of Hunt industrial railways. This will be mailed to any one interested upon request.

THE CAMBRIDGE SCIENTIFIC INSTRUMENT COMPANY, LIMITED, Cambridge, England, has issued catalogue No. 39, illustrating and describing instruments and apparatus used in technical thermometry.

THE HOMER W. HEDGE COMPANY, New York, N. Y., announces that Walter W. Griffith, for the past five years eastern manager for Lord & Thomas, Chicago, Ill., has associated himself with the company.

THE AITON MACHINE COMPANY, New York, N. Y., announces the following changes in the names of the officials of the company: president, Arthur S. Beves; vice-president, Thomas A. Aiton; secretary, John S. Showell.

THE AJAX LINE MATERIAL COMPANY, Chicago, Ill., announces a new line of mast arms, to be ready about September 15, in lengths ranging from six to twenty feet overhang, all fitted with a new type of safety pulley.

THE H. T. PAISTE COMPANY, Philadelphia, Pa., in bulletin No. 34 describes and illustrates plug cutouts, panel cutouts for rotary switches, taplets and attachment plugs. This literature will be sent to any one interested upon request.

H. M. BYLLESBY & COMPANY, INCORPORATED, engineers, Chicago, have been appointed engineers and managers of the Mobile Electric Company, of Mobile, Ala. A new modern power-house will be erected immediately and the lines of the company extended and rebuilt.

THE H. W. JOHNS-MANVILLE COMPANY, 100 William street, New York city, has issued a new catalogue descriptive of insulation of underground pipes conveying steam and hot water by the Portland conduit system. This system consists of the sectional installation of conduit sections supported upon specially adapted frames.

THE H. KRANTZ MANUFACTURING COMPANY, 160-166 Seventh street, Brooklyn, N. Y., has ready for distribution bulletin No. 18. This describes and illustrates type "H. K." knife switches for all circuits, fuse blocks, triple-throw switches and other electrical specialties.

GEORGE P. HUTCHINS, 120 Liberty street, New York city, has been appointed advertising agent for the Illuminating Engineering Society. The monthly proceedings of the society will carry a limited amount of advertising bearing directly and exclusively upon problems of scientific illumination.

THE AUTOMATIC ELECTRIC COMPANY, Chicago, Ill., announces the sale of a complete automatic telephone exchange of 2,600 lines, for immediate installation, to the Richmond Home Telephone Company, Richmond, Ind. The automatic equipment will replace the manual apparatus now in use by the Richmond company.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Rochester, N. Y., reports having closed contracts for switchboards for the following places: Port Byron, N. Y.; Shickshinny. Pa.; Packwaukee, Wis.; Knoxville, Tenn.; Port Williams, Wash.; Waterport, N. Y.; Sioux City, Iowa; St. Marys, W. Va.; Shell Mound, Tenn.; Bridgeport, Minn.; Kentwood, La.; Palouse, Wash.

THE DEVEAU TELEPHONE MANUFACTURING COMPANY, New York, N. Y., has issued another of its unique little folders on the advantages of the DeVeau type of intercommunicating telephone. This company has developed this apparatus to such a point that it is practically perfect in all its operations, and is so constructed that it is most permanent for the service and artistic in design.

THE CRESCENT COMPANY, Valparaiso, Ind., has recently purchased the machinery and business of the P. R. Wagor Company, Springfield, Mass., and has moved the machinery to Valparaiso, Ind., and is now manufacturing the Wagor company's well-known line of protector lamp guards. The company has recently published a circular describing this line of guards. The literature and full information will be furnished upon request.

THE GOULD STORAGE BATTERY COMPANY, New York, N. Y., has ready for distribution a new booklet descriptive of Gould telephone batteries. After September 1 the company will have permanent San Francisco, Cal., headquarters in the restored Monadnock Building. Previous to the earthquake and fire the company had offices in the Crossley Building which was destroyed, while for the last four months temporary offices at 1701 Geary street have been occupied.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is calling attention to the features of type M and type MH transformers with an attractive mailing folder. Bulletin No. 72 gives more complete information concerning the apparatus. Type M transformers are designed for heavy continuous service, for combined motor and lighting duty. Type MH transformers are designed for lighting duty. Both of these are of an improved type of shell construction.

THE BALL ENGINE COMPANY, Erie, Pa., reports a very brisk demand for the Corliss four-valve type of engine. Among the recent orders are the following: one 700-horse-power cross-compound for the city of Aurora, Ill.; one 800-horse-power cross-compound for the National Tube Company, Pittsburg, Pa.; two 700-horse-power cross-compound for the Duluth & Iron Range Railway, Duluth, Minn.; one 600-horse-power cross-compound for the Flint Light and Power Company, Flint, Mich.; one 700-horse-power cross-compound for the Pennsylvania Railroad Company, Altoona, Pa.

THE ELECTRIC CONTROLLER AND SUPPLY COMPANY, Cleveland, Ohio, has struck a unique method of calling attention to its type U controllers. The company is sending out a handsomely printed booklet showing forth some of the features of this apparatus, and an addressed postal card calling for bulletin No. 102. The new catalogues which this company has prepared describing the "Dinkey" ventilated controllers and type U controllers are very complete and well worth any trouble it might take to secure them. The company will be pleased to send full information to any one who may have been missed in the distribution of the company's most recent advertising literature.

THE GENERAL RAILWAY SIGNAL COMPANY, New York city, has been awarded the contract for the complete automatic block signaling system for the Nankai Railway Company, Japan. This is the first high-speed railway in Japan to be electrified. The signal system to be installed is known as the "Young" system, and is the same as is being installed by the company for the electric zone of the New York Central & Hudson River Railroad Company, the New York, New Haven & Hartford Railroad and other high-speed lines. The Nankai railway will be a direct-current proposition. The track circuits for controlling the signals will be operated by alternating current supplied from a special single-phase transmission line. The signal line will be supplied from steam-driven, alternating-current generators delivering 2,200 volts at sixty cycles. The blocks will average about a half-mile in length. Each block will be provided with a home and distant signal. The signals will be operated by alternating-current motors taking current from the special signal line. Transformers stepping down from 2,200 to fifty volts will be employed. The lamps and the signals will also be served from the same transformers. The two-rail system will be used. Both of the traffic rails will be used for the return of the propulsion current. This is accomplished by the use of reactance bonds, which, while maintaining the requisite difference of alternating-current potentials between the rails, freely permit the passage of the direct propulsion current. The entire contract for the equipment of the road has been awarded to Takata & Company.